



Illinois  
Environmental  
Protection Agency

Bureau of Water  
P.O. Box 19276  
Springfield, Illinois 62794-9276

January 2004

---

IEPA/BOW/04-001

---

# ***Illinois Groundwater Protection Program***

## ***Biennial Comprehensive Status and Self-Assessment Report***



*January 2004*

*Prepared by the Interagency Coordinating Committee on Groundwater*

*Printed on Recycled Paper*

217/782-3397

The Honorable Rod Blagojevich  
Governor  
State of Illinois

The Honorable Members  
of the Illinois General  
Assembly

I am pleased to transmit our biennial report entitled, "Illinois Groundwater Protection Program", which has been prepared pursuant to Section 4(b)(8) of the Illinois Groundwater Protection Act, 415ILCS55/4 (Act). This is the seventh biennial report of the Interagency Coordinating Committee on Groundwater with input from the Groundwater Advisory Council and four Priority Regional Groundwater Protection Planning Committees. This report provides a policy perspective on groundwater quality and quantity protection in Illinois, including a comprehensive status and assessment of the program. Further, this document provides the reporting required, concerning a water quantity planning and management program, pursuant to Executive Order #5.

The Act created a comprehensive, prevention-based policy focused on the beneficial uses of groundwater and preventing degradation. As shown in the report, much progress has been made but much more is needed, especially in regard to vulnerable regional groundwater supporting potable uses.

The report gives the status of various elements of groundwater protection, and provides future directions for groundwater protection program activities. The report also includes several figures and tables to help document our progress.

Sincerely,

Renee Cipriano  
Director

## TABLE OF CONTENTS

EXECUTIVE SUMMARY .....	1
Introduction and Background .....	12
CHAPTER I. INTERAGENCY COORDINATING COMMITTEE ON GROUNDWATER OPERATIONS .....	12
CHAPTER II. GROUNDWATER ADVISORY COUNCIL OPERATIONS .....	22
CHAPTER III. EDUCATION PROGRAM FOR GROUNDWATER PROTECTION .....	23
CHAPTER IV. GROUNDWATER EVALUATION PROGRAM .....	33
CHAPTER V. GROUNDWATER QUALITY STANDARDS AND TECHNOLOGY CONTROL REGULATIONS .....	40
CHAPTER VI. WELLHEAD PROTECTION PROGRAM .....	44
CHAPTER VII. REGIONAL GROUNDWATER PROTECTION PLANNING PROGRAM .....	48
CHAPTER VIII. NON-COMMUNITY AND PRIVATE WELL PROGRAM .....	60
CHAPTER IX. GROUNDWATER QUALITY PROTECTION RECOMMENDATIONS AND FUTURE DIRECTIONS .....	66
APPENDIX I. GROUNDWATER AND RELATED PUBLICATIONS BY THE ISGS AND ISWS, 2002-2003 .....	70
APPENDIX II. WATER SUPPLY PLANNING AND MANAGEMENT PROJECTS FOR THE ISWS, DNR INTEGRATED WATER QUANTITY PLANNING AND MANAGEMENT PROGRAM .....	75
APPENDIX III. GROUNDWATER EDUCATION PROGRAM SURVEY RESULTS .....	84
APPENDIX IV. GROUNDWATER AND RELATED PUBLICATIONS BY THE UNITED STATES GEOLOGICAL SURVEY .....	88
APPENDIX V. ADDITIONAL REPORTS DEVELOPED BY OR FOR THE ILLINOIS EPA, 2002-2003 .....	89

## LIST OF FIGURES

Figure 1	Ambient Network of CWS Wells Showing Trends for Selected Analytes (J. Konczyk, 2004, Illinois EPA)	4
Figure 2	Occurrence of Pesticides in Subunits Mapped by Kiefer during sampling conducted September 1998 through August 1999 and September 2000 through August 2002	18
Figure 3	Illinois Department of Agriculture Dedicated Monitoring Network Wells	19
Figure 4	Community Water Supply Groundwater Protection Area Management Status by Susceptibility	45
Figure 5	Illinois Department of Public Health Construction Permits Issued	62
Figure 6	Illinois Department of Public Health Wells Sealed	63

## ACRONYM GLOSSARY

Act	Illinois Environmental Protection Act
API	American Petroleum Institute
BMP	Best Management Practices
BGD	Billion Gallons per Day
Board	Illinois Pollution Control Board
BOL	Bureau of Land
BOW	Bureau of Water
COE	U.S. Army Corps of Engineers
CRS	Contamination Response Subcommittee
CWS	Community Water Supply
DCEO	Department of Commerce and Economic Opportunity
DNR	Department of Natural Resources
DNP	Dedicated Nature Preserve
DOQ	Digital Orthophotoquarter Quadrangle
DRG	Digital Raster Graphics
ENTICE	Environmental & Nature Training Institute for Conservation Education
EPA	Environmental Protection Agency
GAC	Groundwater Advisory Council
GEM	Groundwater Education Materials
GIS	Geographic Information System
GWQS	Groundwater Quality Standard
H2O Works	Waterworks Database
IDA	Illinois Department of Agriculture
IAC	Illinois Administrative Code (also, Ill. Adm. Code)
IAGP	Illinois Association of Groundwater Professionals
ICCG	Interagency Coordinating Committee on Groundwater
IDNS	Illinois Department of Nuclear Safety
IDOT	Illinois Department of Transportation
IDPH	Illinois Department of Public Health
IEHA	Illinois Environmental Health Association
IEMA	Illinois Emergency Management Agency
IFCA	Illinois Fertilizer and Chemical Association
IGA	Illinois Groundwater Association
IGPA	Illinois Groundwater Protection Act
ILSAM	Illinois Streamflow Assessment Model
IML	Illinois Municipal League
IMS	Internet Map Server
IPWSOA	Illinois Potable Water Supply Operators Association
ISAWWA	Illinois Section American Water Works Association
ISBE	Illinois State Board of Education
IWIP	Illinois Water Inventory Program
IWWAP	Illinois Water Well Abandonment Program
IWWSC	Illinois Water Well Sealing Coalition

IRWA	Illinois Rural Water Association
ISGS	Illinois State Geological Survey
ISWS	Illinois State Water Survey
LIRB	Lower Illinois River Basin
MAC	Mahomet Aquifer Consortium
MCL	Maximum Contaminant Level
MGD	Million Gallons per Day
MTAC	Midwest Technology Assistance Center
MTBE	Methyl tertiary-Butyl Ether
NAWQA	National Water – Quality Assessment
NCPWS	Non-community Public Water Supply
NCWS	Non-community Water Supply
NIPC	Northeastern Illinois Planning Commission
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NSDI	National Spatial Data Infrastructure
OCS	Office of Chemical Safety
OSFM	Office of the State Fire Marshal
P2	Pollution Prevention
Plan	Groundwater Resources Management Plan
PPB	Parts per Billion
PPM	Parts per Million
PVC	Polyvinyl Chloride
PWD	Public Water District
PWS	Public Water Supply
SAIC	Science Applications International Corporation
SDWA	Safe Drinking Water Act
SDWIS	Safe Drinking Water Information System
SEP	Special Exception Permit
SOC	Synthetic Organic Chemical
SWAP	Source Water Assessment Program
SWCD	Soil and Water Conservation District
SWP	Source Water Protection
TMDL	Total Maximum Daily Loadings
UI Extension	University of Illinois Extension
UIRB	Upper Illinois River Basins
U.S. EPA	United States Environmental Protection Agency
USDA	United States Department of Agriculture
USGS	United States Geological Survey
VOC	Volatile Organic Chemical
WET	Water Education for Teachers
WRAC	Water Resources Advisory Committee
WHPA	Well Head Protection Area
WHPP	Wellhead Protection Program
µg/L	Micrograms per Liter

## EXECUTIVE SUMMARY

The Illinois Groundwater Protection Act (IGPA) (P.A. 85-0863, 1987) responds to the need to manage groundwater by emphasizing a prevention-oriented process. The IGPA is a comprehensive law that relies upon a state and local partnership. Although the IGPA is directed toward protection of groundwater as a natural and public resource, special provisions target drinking water wells. The IGPA responds to the need to protect groundwater and establishes a unified protection program by:

- Setting a groundwater protection policy;
- Enhancing cooperation;
- Establishing water well protection zones;
- Providing for surveys, mapping and assessments;
- Establishing authority for recharge area protection;
- Requiring groundwater quality standards; and
- Requiring technology control regulations.

The Interagency Coordinating Committee on Groundwater (ICCG) is required to report biennially to the Governor and General Assembly on Groundwater quality and quantity, and the state's enforcement efforts. The Director of the Illinois Environmental Protection Agency (EPA) chairs the ICCG. The ICCG considers diverse stakeholder input from the Groundwater Advisory Council (GAC) and four Priority Regional Groundwater Protection Planning Committees in developing groundwater protection policies and programs.

The groundwater policy, established by the IGPA, sets the framework for management of groundwater as a vital resource. The law focuses upon uses of the resource and establishes statewide protection measures directed toward potable water wells. In addition, local governments and citizens are provided an opportunity to perform an important role for groundwater protection in Illinois.

***What are the Dimensions of Water Availability in Illinois?*** Illinois is a water-rich state with resources adequate to meet most existing and future demands for water. However, in areas with high population growth future demands may well exceed existing available water resources. In areas of rapid and extensive growth there is a competition for water to meet demands. These include *off-stream* uses of water such as public supplies, industry, commercial concerns, power generation, agriculture, and irrigation, as well as *in-stream* uses such as navigation, wildlife, aquatic habitats, and waste dilution. Furthermore, drought can temporarily reduce water supplies in any area, creating competition for a limited resource. (Illinois State Water Survey (ISWS), 2003)

***Where does our water come from?*** The hydrologic cycle for Illinois shows that, on average, Illinois receives 100 billion gallons per day (bgd) from precipitation, 5percent of the available moisture in the atmosphere. About 77 bgd of water are returned to the atmosphere through evaporation from water and land surfaces and transpiration from growing plants. Average flow for all streams in Illinois is estimated to be roughly 28 bgd. Illinois also obtains two bgd from Lake Michigan, and other sources are the low flows of the Mississippi and Ohio Rivers, which amount to 19 bgd.

Sources of fresh water vary greatly across the state. Most communities in the southern half of Illinois depend on surface water mainly in rivers, lakes, and reservoirs.

Groundwater comes from wells that tap into aquifers at varying depths. Owing to Illinois' geology, the northern third of the state has several high-yielding aquifers and most communities there rely upon groundwater. These aquifers include numerous sand-and-gravel aquifers above the bedrock surface, shallow bedrock dolomite and limestone aquifers (less than 300 feet deep), and deep bedrock limestone and sandstone aquifers (>300 feet deep). Water quantity and its quality varies greatly among aquifers. Farms and rural residents all across Illinois rely on private shallow wells for their water supply. (ISWS, 2003)

***How is Water Used in Illinois?*** Water is used for many diverse purposes. In-stream uses include sustaining fish and wildlife habitats, maintaining water quality, generating power, navigating the larger rivers, recreation and aesthetics, and overall biological integrity of rivers and streams. Water quantity, quality, and riverine health are all closely connected. Groundwater is withdrawn for public, industrial, and commercial uses and is also a major source of water for irrigation. Withdrawals of groundwater in Illinois average about one billion gallons per day (bgd) and serve about a third of the state's population.

In the 1990s, Illinois used 20 bgd, and 95percent (19 bgd) came from surface water sources. Thermoelectric power generation, easily the state's greatest water user, used 17 bgd, and much of this was recycled. Four other major uses of water in Illinois amount to three bgd, with public water supplies being the second largest user of water. Usage of public water supplies has grown substantially: from 36percent of non-power plant usage in Illinois during 1950, to 63percent in 1998.

Northeastern Illinois, the state's major consumer of water, depends heavily on water from Lake Michigan. Groundwater pumpage is also a large source of water for many Chicago suburbs. Diversion of lake water averages 3,200 cubic feet per second (about two bgd); about 1.1 bgd is for public water supply, which represents 41percent of Illinois' total water withdrawals for all purposes, excluding power generation. Water usage values for Illinois must be used with caution because reporting is voluntary, and many users do not report amounts used. (ISWS, 2003)

***Groundwater Importance:*** Safe and adequate water supplies are vital for public health and necessary for local and regional economic development. There are 5,084 public water supplies in Illinois of which 1,263 are community water supplies (CWS) that are dependent on groundwater as their source of water. These CWS serve approximately three million people. An additional seven community water supplies utilize a mixture of surface water and groundwater sources. These systems provide approximately one-half million individuals potable water. Furthermore, approximately 400,000 residences in the state are served by private water supply wells.

Groundwater also provides up to 80 percent of the base flow to streams in many areas of the state and is essential to watershed ecology. In 1980 the ISWS publication entitled “Groundwater Discharge to Illinois Streams” indicated that the regions with the highest base flows are in northeastern and southeastern Illinois, with the areas in north-central Illinois yielding the next highest base flow values.

***How good is the water?*** Groundwater quality is a high priority in Illinois. Water quality degradation or contamination resulting from point and nonpoint sources throughout the state is of concern. In many industrialized parts of the state (including the metropolitan areas of Chicago, Rockford, and East St. Louis) groundwater in glacial deposits and bedrock aquifers has been degraded by improperly contained or disposed of chemicals. In some agricultural areas, the quality of groundwater in the underlying shallow aquifers has been degraded by the routine application of agricultural chemicals. Surface water quality has been degraded in some areas because of the influx of contaminated groundwater. To this end, the Illinois EPA continues to evaluate the question of how good is the water by implementing an ambient monitoring network of CWS wells as illustrated in Figure 1. The Illinois EPA utilizes this Ambient Network to:

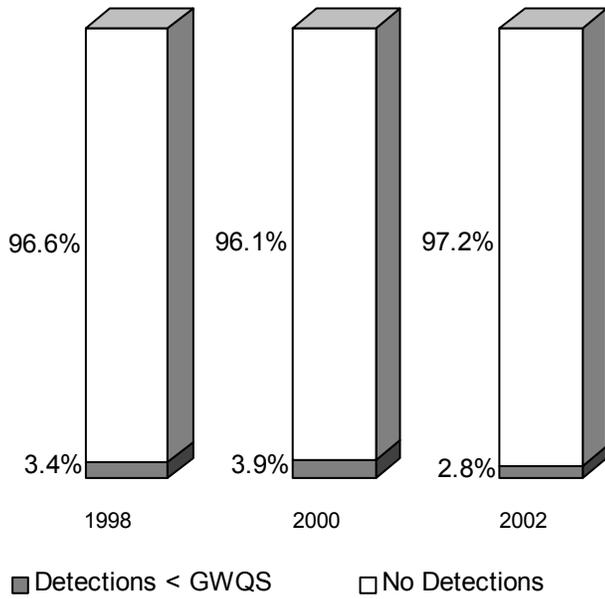
- Provide an overview of the groundwater conditions in the CWS Wells in Illinois;
- Provide an overview of the groundwater conditions in the major aquifers in Illinois;
- Establish baselines of water quality within the major aquifers in Illinois; and
- Identify trends in groundwater quality in the major aquifers in Illinois.

Water quality parameters sampled for include: field temperature, field specific conductance, field pH, field pumping rate, inorganic compounds (IOC), volatile organic compounds (VOC), and synthetic organic compounds (SOC).

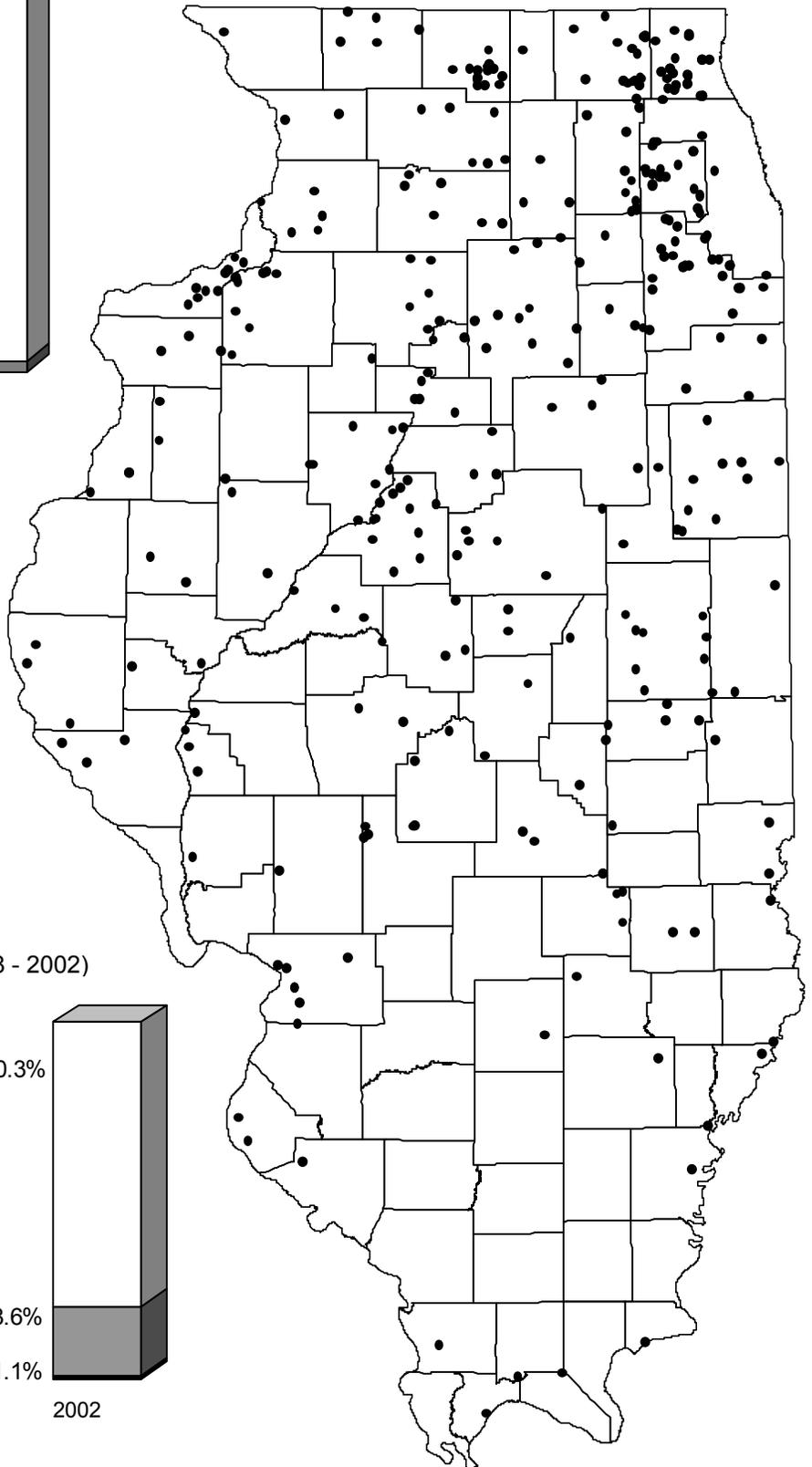
Figure 1 summarizes trends in the Ambient Network for VOCs and nitrate. As shown by the graphs, VOC detections have fluctuated over the past five years (three Ambient Network cycles) with 2002 showing the lowest concentration of wells with detections. During these five years only 1998 recorded a VOC detection that exceeded the Groundwater Quality Standard (GWQS). Nitrate detections have also fluctuated in overall frequency. However, unlike the VOCs, nitrate concentrations exceeding the GWQS have also fluctuated with the lowest number of detections recorded in the 2000 ambient cycle. SOCs were also considered for this analysis. SOC analytes have been consistently below quantifiable levels within the Ambient Network with the exception of one sample from the 2000 cycle, which was below the GWQS.

In addition to the Illinois EPA’s Ambient Network, the Illinois Department of Agriculture has implemented a monitoring well network for pesticides in shallow groundwater aquifers to assist with implementation of Illinois’ Generic Pesticide Management Plan that has been endorsed by the United States Environmental Protection Agency (U.S. EPA). For more information regarding this program refer to Chapter 1, Section 6.

### Ambient Wells With VOC Detections (1998 - 2002)



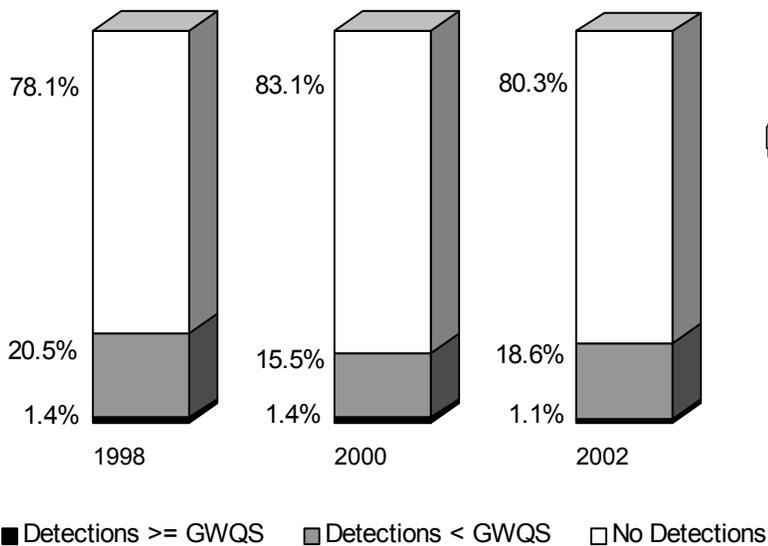
### Location of Illinois EPA's Ambient Network Wells



**Figure 1.** The Ambient Network of Wells consists of 356 wells at various locations, and depths, within the state. VOC and SOC samples are analyzed at the Illinois EPA Laboratory located in Springfield, IL. IOC samples are analyzed at the Illinois EPA Laboratory located in Champaign, IL

All VOC and SOC concentrations are analyzed in micrograms per liter ( $\mu\text{g/l}$ ). Nitrate (an IOC) is analyzed at milligrams per liter ( $\text{mg/l}$ ). \*Nitrate samples were considered detections if found to equal or exceed  $0.1\text{mg/l}$ .

### Ambient Wells With Nitrate Detections\* (1998 - 2002)



***What are the Challenges for Illinois Water Supplies?*** Numerous challenges exist in making water available in Illinois. These fall into four general classifications: 1) human-related limitations, 2) reduction of some existing supplies, 3) growth of use and future demands, and 4) uncertain fluctuations in supplies.

A changing society with increasing laws, rules, and regulations pertaining to a better understanding of the environment, water, and land use has created a complex maze. Growth of urban areas, increased water use, and lack of available space for water storage collectively increase water costs and those of developing new sources. These societal changes, population growth, and growing demands have led to more conflicts over water supplies. Although much data on water supplies and use have been collected, they are not complete, particularly about many water uses, thereby limiting wise decision-making. Past water supply planning too often has been fragmentary, with few recommendations for improvements adopted.

Some water supplies have dwindled for several reasons. A significant fraction of all water obtained is wasted and demand could be reduced through conservation. Human pollution has impaired water resources. Reservoirs have lost capacity due to sediment accumulation. Over-pumpage of aquifers, resulting in serious depletion of critical groundwater supplies, has long been a problem in deep bedrock aquifers in northeastern Illinois where demands are high. Recharge of some aquifers may require decades to centuries, so those depleted aquifers will remain serious problems for many years.

Illinois' ever-growing population and commercial base increasingly demand quality water supplies. Projections of demands for metropolitan Chicago and other major urban areas show water shortages will appear soon if nothing is done. Another problem is uncertain fluctuations in supplies due to climatic extremes such as droughts and floods. Droughts quickly can create water shortages, and floods often damage wastewater treatment facilities and send polluted water into streams and rivers. Although there are major scientific uncertainties about the type of climate change that will occur in Illinois, the state's precipitation and temperatures will change, placing additional stress on water supplies, depending on the types and magnitudes of climate change. (ISWS, 2003)

***What are the Costs of Water Supplies?*** All water has a price. Some costs are related to accessing a source and the system for water distribution/transport. Others are for treatment before and after usage. Even rural residents must pay to have a well drilled and piping installed. Due to frequent hardness and iron in waters from shallow aquifers, rural residents also must pay a continuing cost for water treatment. Use of bottled water has mushroomed in recent years, and represents another cost.

Costs of water treated for public consumption vary widely across the state. Most providers sell water by volume, but some do not. A Chicago residence receives water at a fixed monthly cost, regardless of how much is used. Conversely, many suburbs charge by quantity used. For example, the average rate for Chicago suburbs that use Lake Michigan water is \$3.23 per 1000 gallons, compared to \$2.08 in Champaign, and \$2.64 in De Kalb.

Some public systems are privately owned, but many others

are owned by the community. Costs of water in Illinois also differ greatly from those in the drier West. Water rates in Boulder, Colorado, are two to three times higher than rates in most Illinois communities, and rates in Billings, Montana, range from three to four times higher than most rates in Illinois. Municipal water costs \$4.7 per 1,000 gallons in Fresno, California, and \$15.30 in Ft. Worth, Texas, compared to less than \$4 in most Illinois communities. Some Illinois municipalities even have rates that decrease as usage goes up. For example, the rate in Marion for the first 5,000 gallons used, \$3.7 per 1,000 gallons, decreases to \$3.3 per 1,000 gallons for the next 5,000 gallons, and then drops to \$3.10 if use exceeds 40,000 gallons. In contrast, Boulder, Colorado, charges \$5.70 per 1,000 gallons for 5,000 gallons or less per month, but the rate jumps to \$6.25 for usage in excess of 5,000 gallons. (ISWS, 2003)

**Cost of Water at Selected Communities Across Illinois**

Water rates (dollars per 1000 gallons) for residential users in selected communities during 2000-2002. Commercial users in some of these communities may pay higher or lower rates than those shown. Rates for residential and commercial users also may fluctuate higher or lower, depending on the volume of water used.

City	Price	City	Price
Addison	\$3.46	Mahomet	\$2.00
Bloomington	3.16	Mt. Vernon	2.23
Blue Island	2.44	Naperville	2.70
Calumet City	2.23	New Lenox	3.85
Carol Stream	3.25	Palatine	1.56
Champaign	2.08	Park Ridge	3.17
Chicago	1.08	Peoria	2.92
Clarendon Hills	4.75	Quincy	10.40
DeKalb	2.64	Riverside	5.61
Evanston	1.96	Round Lake	4.95
Frankfort	1.72	Salem	9.75
Grayslake	3.64	Springfield	1.01
Homewood	3.48	Tinley Park	2.34
Libertyville	3.69	Utica	3.17
Lisle	3.40	Warrenville	1.20
Marion	3.70	Waukegan	1.74

This information was obtained from local water companies and from the Office of Water Resources in Chicago.

**Efforts to Protect Groundwater:** Protection of Illinois' valuable groundwater resource is especially critical. Each of the agencies and departments has implemented programs that protect groundwater resources. For example, the Illinois EPA has made considerable

The IGPA is a comprehensive law that relies upon a state and local partnership. The Interagency Coordinating Committee on Groundwater (ICCG) is comprised of the following:

- ENVIRONMENTAL PROTECTION AGENCY
- DEPARTMENT OF NATURAL RESOURCES
  - OFFICE OF WATER RESOURCES
  - OFFICE OF MINES AND MINERALS
- DEPARTMENT OF PUBLIC HEALTH
- OFFICE OF THE STATE FIRE MARSHAL
- DEPARTMENT OF AGRICULTURE
- EMERGENCY MANAGEMENT AGENCY
- DEPARTMENT OF COMMERCE AND ECONOMIC OPPORTUNITY
- DEPARTMENT OF NUCLEAR SAFETY

*Also attending the ICCG meetings are: Illinois Department of Transportation's Division of Highways; U.S. Geological Survey; ICCG Groundwater Education Coordinator; Illinois State Water Survey and Illinois State Geological Survey.*

The GAC is comprised of: two business, two environmental, one regional planning; one agricultural; one public water supply; one water well drilling industry; and one local and county government representative.

progress in groundwater protection through such initiatives as the groundwater standards, Regional Groundwater Protection Planning Programs, and the Safe Drinking Water Act (SDWA) Monitoring Waiver and Consumer Confidence Reporting Programs. Significant groundwater cleanups and restoration efforts have also been implemented that have helped restore groundwater quality.

Illinois continues to address the need for

protecting groundwater by accomplishing the mission set forth in the IGPA and through federal, state and local partnerships establishing groundwater protection programs.

### ***Program Highlights- 2002 through 2003:***

#### Interagency Coordination Committee on Groundwater/Groundwater Advisory Committee

The ICCG/ Groundwater Advisory Committee (GAC) spent a tremendous amount of time and effort responding to Executive Order #5, dealing with water quantity planning and management. ICCG and GAC representatives also participated in the ICCG Subcommittee on Integrated Water Planning and Management. The ICCG/GAC reviewed the subcommittee report and prepared a summary report that was provided to the Governor and General Assembly pursuant to the executive order. This effort continues to provide the cornerstone of recommendations for future efforts.

An ICCG Subcommittee also developed and implemented a coordinated groundwater contamination response strategy. This strategy also led to the amendment of the IGPA to provide notice and impetus to private well owners near contaminated CWS to test their wells for VOCs. In addition, the ICCG Groundwater Education Subcommittee, chaired by the Department of Natural Resources (DNR), continues to be a national leader in comprehensive education programs developed and implemented.

#### Department of Commerce and Economic Opportunity

Good water is good business, and Department of Commerce and Economic Opportunity continues to provide this balance, and perspective to Illinois' groundwater protection programs.

#### Illinois Emergency Management Agency

Illinois Emergency Management Agency (IEMA), including the Department of Nuclear Safety, is the lead with respect to homeland security in Illinois. Security of our critical water supplies has been a focus post September 11.

#### Department of Natural Resources Programs

Illinois' State Geological and Water Surveys along with the United States Geological Survey (USGS) continue to conduct nationally recognized research that contributes to groundwater protection in Illinois. Over the last two years these scientific surveys have made considerable progress in automating data in a format that is easily accessible by the public, water resource managers and decision makers.

Department of Natural Resources' (DNR) Office of Water Resources was the primary lead with respect to the water quantity planning and management programs being implemented in Illinois. Further, they are the regulatory arm of DNR that implements the Lake Michigan Allocation Act and other public water body water allocations. Moreover, they chair the Illinois State Water Plan Task Force and co-chair the drought management task force with Illinois EPA.

The Office of Mines and Minerals continues to work with their regulated constituency to assist with compliance and enforcement of Illinois groundwater quality standards.

#### Office of the State Fire Marshal

The Office of the State Fire Marshal (OSFM) continues to do a good job of issuing permits for new underground gasoline storage tanks with modern day technology controls and prevention monitoring devices. Further, they continue to condition permits to comply with potable well setback requirements and coordinate with the appropriate agencies.

#### Illinois Department of Agriculture

The Illinois Department of Agriculture (IDA) continues to permit secondary containment devices for agricultural chemical facilities and is the lead with respect to livestock management and the protection of water resources. Additionally, the IDA has and is operating a dedicated groundwater monitoring well network sampled for pesticides, the results of which are published in this report for the first time. In addition, IDA continues to operate numerous training, registration, and certification programs that protect groundwater.

### Illinois Department of Public Health

The Illinois Department of Public Health (IDPH) plays a key role in protecting public health. They continue to operate programs that help protect groundwater including, but not limited to: training; water well and private sewage disposal codes; and licensing well drillers; and permitting, inspection, and well abandonment programs for private, semi-private and non-community water supply wells. The department operates through delegation to local health departments. Further, the department is near completion of source water assessments for every non-community water supply in the state.

### Illinois EPA and Partners

The 1996 amendments to the federal SDWA required states to develop and implement a source water assessment program (SWAP). Source water protection (SWP) is a proactive approach to protecting our critical sources of public water supply and assuring that the best source of water is being utilized to serve the public. It involves implementation of pollution prevention practices to protect the water quality in a watershed or wellhead protection area serving a public water supply. Along with treatment, it establishes a multi-barrier approach to assuring clean and safe drinking water to the citizens of Illinois.

Pollution prevention, like preventive medicine, starts with awareness. Thus, source water assessment is the cornerstone essential to the development and implementation of source water protection plans and includes the following:

- Delineating the source water protection area (e.g., watersheds and wellhead protection areas);
- Inventorying potential contamination sources;
- Determining the susceptibility of the source water to contamination;
- Providing recommendations to protect the source water; and
- Providing this information to the public.

Illinois was one of the first programs in the country to obtain approval of its ambitious assessment program by U.S. EPA. Under Illinois' approved source water assessment program the Illinois EPA completed the majority of the assessments for CWS by the deadline of May 2003. Illinois EPA was one of a handful of states to be this far along in the assessment process by the May 2003 deadline. Moreover, Illinois ranked among the top states within U.S. EPA Region V for completing the assessments and providing them to the public to assist with implementing protection efforts, as follows:

<b>State</b>	<b>Total CWS</b>	<b>Percent Complete</b>
Illinois	1,802	98percent
Indiana	865	16percent
Michigan	1,468	0percent
Minnesota	956	100percent
Ohio	1,355	54percent
Wisconsin	1,113	1percent
<b>TOTAL</b>	<b>7,559</b>	<b>49percent</b>

One of Illinois EPA's highest priorities is to make environmental information available electronically to a variety of stakeholders. Since the 911 tragedies and concern about securing information regarding the location of public water supply wells and intakes, the Illinois EPA and the USGS developed a secure website. The secure website is accessible to state, local and federal government staff. In addition, the site is accessible to consultants that have received security clearance through Illinois EPA's Freedom of Information Act process. This site includes detailed source water assessment fact sheets and an interactive Internet Geographic Information System (GIS). The Illinois EPA's SWP GIS system has won praise by being nominated for Urban and Regional Information Systems Association, Exemplary Systems in Government Award. Illinois EPA has also developed an additional website for other public stakeholders that contains a summary of the source water assessments without the security sensitive locational information. Summaries have also been provided to community water supply officials to include in their drinking water Consumer Confidence Reports distributed to the public.

The Groundwater Foundation continues to nationally recognize the Illinois EPA as a groundwater protection leader. This continued national recognition is based in the implementation of results oriented services for protecting groundwater. Illinois' Groundwater Affiliate team is led by Illinois EPA, and promotes the Groundwater Guardian Program within the four priority Groundwater Protection Planning Regions in the state. In addition, our team promotes this program, as necessary, with other communities throughout the state, as well as with general statewide committees and organizations (e.g., USGS, DNR, Illinois Rural Water Association (IRWA), U.S.EPA-Region V, others). Moreover, the Groundwater Foundation has honored Illinois citizens for the past three years with national award recognition, as follows:

- Pat Welch 2003 *Edith Stevens Groundwater Educator*;
- Bob Williams 2002 *Edith Stevens Groundwater Educator*; and
- Bill Compton 2001 *Vern Haversack Award*.

This is a tribute to the types of persons that we are blessed to work with in Illinois. The Illinois EPA continues to work with 567 CWS implementing SWP programs that are implementing protection measures under the conditions of a Special Exception Permit (SEP) issued by Illinois EPA. The Illinois EPA has developed an interim database system to report new source water protection measures and progress to the U.S. EPA electronically.

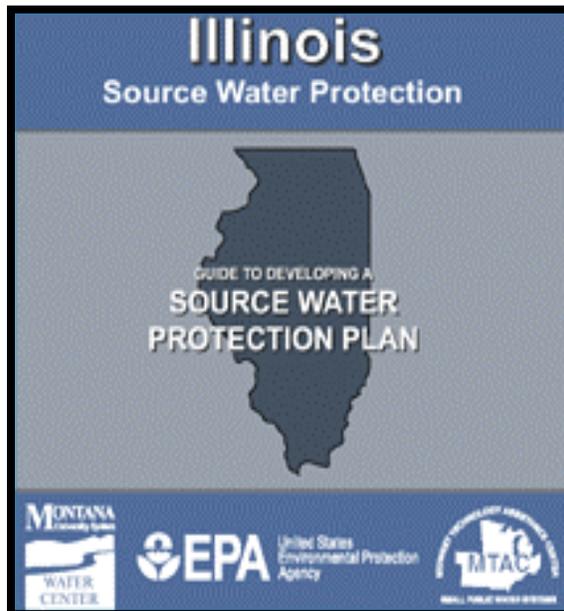
Patricia Welch, Emergency Response Coordinator for the Illinois Department of Public Health, has been selected to receive the *Edith Stevens Groundwater Educator Award* for 2003. Ms. Welch was presented this award on November 13, 2003, at the Groundwater Foundation's Annual Conference in Las Vegas, Nevada. Ms. Welch chaired the education subcommittee on the Central Regional Groundwater Protection Committee from 1991 to 2003.

The Illinois EPA has developed a program to reduce the cost and burden of required monitoring for supplies that are implementing SWP programs. This Illinois EPA program not only has the economic benefit of protecting source water, and thereby avoiding the expense of remediation, liability costs or seeking alternative water sources, but it also directly saves Illinois communities the following:

- \$363,144 per year and **\$3,268,300** over a nine-year period in analytical costs for synthetic organic chemical; and
- \$21,150 a year and **\$126,900** over a 6-year period for volatile organic compound sampling and analysis costs.

Community water supplies across the state have saved millions of dollars in laboratory fees due to the implementation of the SWP measures under Illinois EPA's monitoring waiver SEP. In addition, these SWP measures help prevent contamination of these critical drinking water supplies.

The Illinois EPA and IRWA worked with the Montana Water Resources Center to develop a new web-based/CD interactive *Guide to Developing a Source Water Protection Plan* through a U.S. EPA grant to the Midwest Technical Assistance Center. This program has already received approval for 7.5 hours of renewal training credit under Illinois' certified drinking water supply operator program. This interactive learning tool also includes water supply operator basics. In Illinois, up to 14.0 hours of training can be documented by working through all 11 units of Ground Water Basics 2003. The CD was distributed to water supply owners and operators at the annual Illinois Potable Water Supply Operators and at the Illinois Municipal League conferences in 2003.



The Illinois EPA has developed work plans on the integration of staff from the Groundwater and Field Operations Sections in the Bureau of Water. This integration is intended to assist with promoting SWP in the field with the owners and operators of CWS, and will assist with ambient monitoring, and water system inspections.

The Illinois Pollution Control Board designated the area contributing groundwater to Fogelpole Cave, a Dedicated Nature Preserve, as Class III: Special Resource Groundwater. Fogelpole Cave is located in the southern part of Monroe County.

#### **2004 Through 2005 Recommendations**

The ICCG with input from the GAC and four-priority groundwater protection planning regions recommend that quality programs continue to be developed and implemented that protect groundwater including: educating the public; promotion and implementation of programs to protect source water; research; assessment and resource monitoring; integration with a watershed approach; regulatory and non-regulatory programs; information technology; permitting; regulatory development; compliance; enforcement; and regional planning.

## INTRODUCTION

The intended purpose of this report is threefold. First, the report is intended to provide a comprehensive status report on the implementation of the Illinois Groundwater Protection Act (IGPA). Secondly, the report is intended to provide a self-assessment of program initiatives in relation to the goals and objectives of the program recommended in the IGPA Biennial Report, published January 2002. Finally, this report is intended to provide environmental and programmatic indicators to help measure and demonstrate program performance.

The current report has been organized according to the following recommended goals:

- Interagency Coordinating Committee on Groundwater (ICCG) operations;
- Groundwater Advisory Council (GAC) operations;
- Groundwater protection education program;
- Groundwater evaluation program;
- Groundwater quality standards and technology control regulations;
- Wellhead protection program (WHPP);
- Regional groundwater protection planning program;
- Non-community and private well program overview; and
- Enhanced private well program initiatives.

## CHAPTER I. INTERAGENCY COORDINATING COMMITTEE ON GROUNDWATER OPERATIONS

### **Section 1. Assist the GAC in the review and development of recommendations pertaining to groundwater quantity issues**

Executive Order Number 5 (2002), signed on Earth Day 2002, was established because of the critical need to better understand Illinois water resources and plan for their use in a way that both supports balanced growth and protects the resource.

#### *Report of the Subcommittee on Integrated Water Planning and Management to the ICCG -*

The report from the Integrated Water Planning and Management Subcommittee was provided to the ICCG with recommendations pursuant to Executive Order Number 5. The Subcommittee Report concluded by making the following recommendations:

- The ICCG should develop a detailed Statewide Strategic Plan for Water Quantity Planning and Management over the next 12 months (a suggested outline is provided in Appendix IV of the Report);
- The plan should receive broad public review and input;

As a follow-up to the ICCG report to the Governor as set forth in Executive Order #5 (2002), the ISWS launched a new web-site in 2003 on water supply issues in Illinois. The site is laid out in a question and answer format, asking a variety of questions on such topics as the availability of water, water quality, and water law, and providing answers along with links to further resources. See <http://sws.uiuc.edu/docs/wsfaq/> for details.

- The plan should have an initial focus on securing and making easily accessible the scientific data that will be needed to designate Priority Water Quantity Planning Areas, areas that can be identified as being at risk for water shortages based on existing data or as new data become available.
- As Priority Water Quantity Planning Areas are identified, the state should nurture the development of voluntary, cooperative regional water management consortia in those areas by providing technical and financial assistance for planning and management efforts.
- The legislature should address an immediate need to grant the Governor expanded emergency powers to deal with major region-wide droughts or water-related disasters. Under the Emergency Services and Disaster Agency Act of 1988, the Governor has broad emergency powers for 30 days to suspend statutes, regulations and even take real estate. A study of this law suggested that these emergency powers were not sufficiently focused to respond to a drought emergency. The Subcommittee believes seeking appropriate authority is the strategy most likely to avoid both prescriptive regulatory water allocation frameworks and future water quantity crises.
- The state should consider voids in current law like in-stream flow and well interference by initially developing guidelines identifying best management practices (BMPs) for voluntary adoption. Experience with voluntary implementation of such BMPs will clarify whether it is necessary to adopt them statutorily.

The ICCG concurs with these recommendations.

*Significant Initial Progress -*

The ICCG notes that significant initial progress has been made in 2002 as a result of Executive Order Number 5 on Recommendation #3: pulling together information necessary to identify Priority Water Quantity Planning Areas. The first step is to assemble and evaluate the data that exist, and then determine what critical data gaps exist. With significant short-term funding from IEPA, the Illinois State Water Survey (ISWS) has already begun to make several groundwater-related databases more accessible to facilitate evaluation of critical data. These include a groundwater quality database, an aquifer hydraulic properties database and an inventory of water use accumulated over the last century. These databases contain critical information needed for both applied and theoretical groundwater research as well as basic groundwater information useful to the general public especially in northeast Illinois. Progress to date:

- The aquifer properties, Illinois Water Inventory Program, and water quality databases have been transferred to more modern systems. User interface programs are being developed that will enable entering, editing, querying and verifying data. Staff resources have been added for coordination and evaluation of these data.
- The ISWS was able to digitize historic use/yield maps for the state and now those data are being used in new efforts to characterize potential water resources in areas where water supplies may become limited, notably in northeast Illinois.

- Significant progress has been made to inventory and measure the water level of 71 wells at 22 municipal water supplies in the DuPage County portion of the northeastern Illinois shallow dolomite. After all DuPage facilities are visited, activity will shift to western Cook, northern Will and eastern Kane counties so that the natural hydraulic boundaries of the aquifer can be incorporated.
- Improved data entry and updates to the Private Well Database.

There are 28 Scientific Surveys projects listed in Appendix I of the Subcommittee Report, all of which contribute to the data needs for improved water planning and management in a variety of ways. Some projects pull together existing data and information and make them more useful and accessible. Other projects analyze historical data and establish baselines. Other projects gather new data to fill data gaps. Some projects develop models to synthesize and integrate existing data and make projections. And finally, two projects develop and implement new technologies for water treatment, reuse, and conservation. Results from these projects, together with the wealth of data and reports we have over the last 105 years, will be useful in designating priority planning areas, and determining how much water is available and can be safely withdrawn, and the quality of that water.

At the ICCG meeting on December 18, 2003, the DNR reported on the recent ongoing efforts and plans for Water Quantity Planning and Management Implementation. The DNR has established a preliminary framework and staffing plan which addresses the six recommendations on page 3 of the ICCG January 2003 Report to the Governor. The DNR also provided a comprehensive list of Water Supply Planning and Management Projects for the State Water Survey related to implementation of the DNR Integrated Water Quantity Planning and Management Program. This project list was prepared by the State Water Survey and identifies 23 separate projects either currently underway or planned as priority target areas for effective water quantity assessment and management. This document is included as Appendix II.

Apart from this work, Illinois EPA has completed efforts to make consolidated source water information accessible through Arc Internet Map Servers and identify integrated boundaries of major watersheds and aquifers. Future improvements to this source water information system include making geological information, currently available as paper records residing at the Illinois State Geological Survey (ISGS), available to the public on-line.

## **Section 2. Enhance coordination between Illinois EPA Bureau of Water (BOW) and Bureau of Land (BOL) Remediation Programs**

A Groundwater Contamination Response Strategy (Strategy) and legislation (415 ILCS 55/9.1) has been developed and adopted that sets forth procedures to be used by State of Illinois agencies in their response to existing and potential groundwater contamination of private wells by volatile organic compounds (VOCs). The Strategy was developed by the Contamination Response Subcommittee (CRS) of the ICCG and, after consultation with the ICCG and with the GAC, was revised and approved by the ICCG April 1, 2002. The Strategy and legislation (Effective July 25, 2002) was developed to notify private well owners in the vicinity of public water supply wells with contamination detections, of potential groundwater problems in the area. The Strategy requires significant coordination between the BOW, Groundwater Section and the Bureau of

Land (BOL), Division of Remediation Management, to identify potential sources of groundwater contamination and location of private drinking water wells. In the past, operators of these public water supplies have only been obligated to notify homeowners connected to their system about groundwater contamination concerns. To accomplish this task, the Strategy identifies three primary goals and objectives, as described below:

- *Program Goal 1* - All potential private well owners in the vicinity of public water supplies (PWS) contaminated with VOC(s) that exceed groundwater or drinking water standards will be notified by the local health department of the potential risk of their wells being contaminated and be strongly encouraged to sample their wells for VOCs.

*Program Objective 1* - The Illinois EPA will use the geographic information system (GIS) to re-evaluate the area that is adjacent to each of the community water supplies (CWS) where VOCs exceed groundwater or drinking water standards. This technology has just recently become available for this use. In addition, Illinois EPA will also include, in the evaluation, any additional CWS with past VOC detections from ambient or Safe Drinking Water Act (SDWA) compliance monitoring not otherwise already included. The private well data from the ISGS will be overlaid with this existing data to predict areas where private wells may be impacted.

*Program Outcome Measure* – Number of fact sheets that have been developed for CWS with VOCs that exceed groundwater or drinking water standards. Of the 70 total, the Strategy may not be applicable for 34, 13 are under development, and 23 are completed. In addition, 7 are in the process of internal review.

*Program Objective 2* - Further, the Illinois EPA will conduct a file search to determine the proximity of potential contamination source information that may be in this same geographic area, and any known restricted use ordinances adopted in the area.

*Program Outcome Measure* – Number of potential contamination source file searches and restricted use ordinance evaluations that have been conducted relative to each CWS and included with Program Objective 1 fact sheets. (A total of 15 source file searches have been completed.)

*Program Objective 3* - The Illinois EPA will develop a fact sheet and transmittal document that provides the information compiled above to the Illinois Department of Public Health (IDPH) and to the local health department(s).

*Program Outcome Measure* – The number of letters and fact sheets that are sent to IDPH including local health departments pursuant to the agreed upon Strategy and 415 ILCS 55/9.1. (To date, a total of 15 have been referred to IDPH).

### **Section 3. Continue to review and update the Implementation Plan and Regulatory Agenda**

The IGPA required the creation of the ICCG. The ICCG is required to report biennially to the governor and General Assembly on Groundwater quality and quantity, and the state's enforcement efforts. In summary, the ICCG is responsible for:

- Reviewing and coordinating the state's policy on groundwater protection;
- Reviewing and evaluating state laws, regulations and procedures that relate to groundwater protection;
- Reviewing and evaluating the status of the state's efforts to improve the quality of the groundwater and of the state enforcement efforts for protection of the groundwater and make recommendations in improving the state efforts to protect the groundwater;
- Recommending procedures for better coordination among state groundwater programs and with local programs related to groundwater protection;
- Reviewing and recommending procedures to coordinate the state's response to specific incidents of groundwater pollution and coordinate dissemination of information between agencies responsible for the state's response;
- Making recommendations for and prioritizing the state's groundwater research needs; and
- Reviewing, coordinating and evaluating groundwater data collection and analysis.

The Committee is chaired by the director of Illinois EPA or designee and has members from 10 state agencies/departments that have some jurisdiction over groundwater. The ICCG continues to review and update an Implementation Plan and Regulatory Agenda pursuant to the IGPA. The following is a list of participating agencies/departments on the Committee:

- ENVIRONMENTAL PROTECTION AGENCY - (Chair) Marcia Willhite, designee
- DEPARTMENT OF NATURAL RESOURCES - Dave Baker, designee
  - OFFICE OF WATER RESOURCES - Gary Clark, designee
  - OFFICE OF MINES AND MINERALS - Scott Fowler, designee
- DEPARTMENT OF PUBLIC HEALTH - Jerry Dalsin, designee
- OFFICE OF THE STATE FIRE MARSHAL - Dale Tanke, designee
- DEPARTMENT OF AGRICULTURE - Dennis McKenna, designee
- EMERGENCY MANAGEMENT AGENCY - Julia Gentile, designee
- DEPARTMENT OF COMMERCE AND COMMUNITY AFFAIRS - David Kramer, designee
- DEPARTMENT OF NUCLEAR SAFETY - Dave Ed, designee

*Also attending the ICCG meetings are: Steve Gobelman, representing the Illinois Department of Transportation's Division of Highways; Angel Martin, representing the U.S. Geological Survey; Harry Hendrickson, ICCG Groundwater Education Coordinator; Alan Wehrmann, representing the Illinois State Water Survey and Ed Mehnert, representing the Illinois State Geological Survey.*

#### **Section 4. Continue to hold quarterly meetings**

The ICCG continues to hold quarterly meetings. The Committee has met regularly since 1988 to address groundwater protection issues.

#### **Section 5. Provide liaison for the GAC**

The ICCG has continued to assist with coordination associated with the GAC by providing Committee meeting agendas and minutes. The ICCG has also continued to review and make recommendations on groundwater research, data collection, and dissemination programs. The Committee has been successful in coordinating and assisting in many aspects of the groundwater protection program.

The ICCG, as well as its subcommittees and work groups, have helped to provide a cooperative process to develop and implement groundwater protection programs in Illinois.

#### **Section 6. Assist in implementation of the Illinois Generic Management Plan for Pesticides in Groundwater**

The *Illinois Generic Management Plan for Pesticides in Groundwater* targets assessment monitoring to areas where aquifer materials occur within 50 feet of land surface. In 1995, the Illinois Department of Agriculture (IDA) contracted with the ISGS and the ISWS to design and construct a statewide groundwater monitoring well network for use with future pesticide management plans. As originally designed, the network had two major goals: (1) provide data to test the utility of a map of aquifer sensitivity to contamination by pesticide leaching (Keefer 1995b) as a predictive tool for pesticide management plans, and (2) determine if the occurrence of selected agricultural chemicals varies seasonally and over longer periods of time. The network was designed to determine the regional impacts of pesticide leaching from non-point sources, not the impacts of site-specific, point sources.

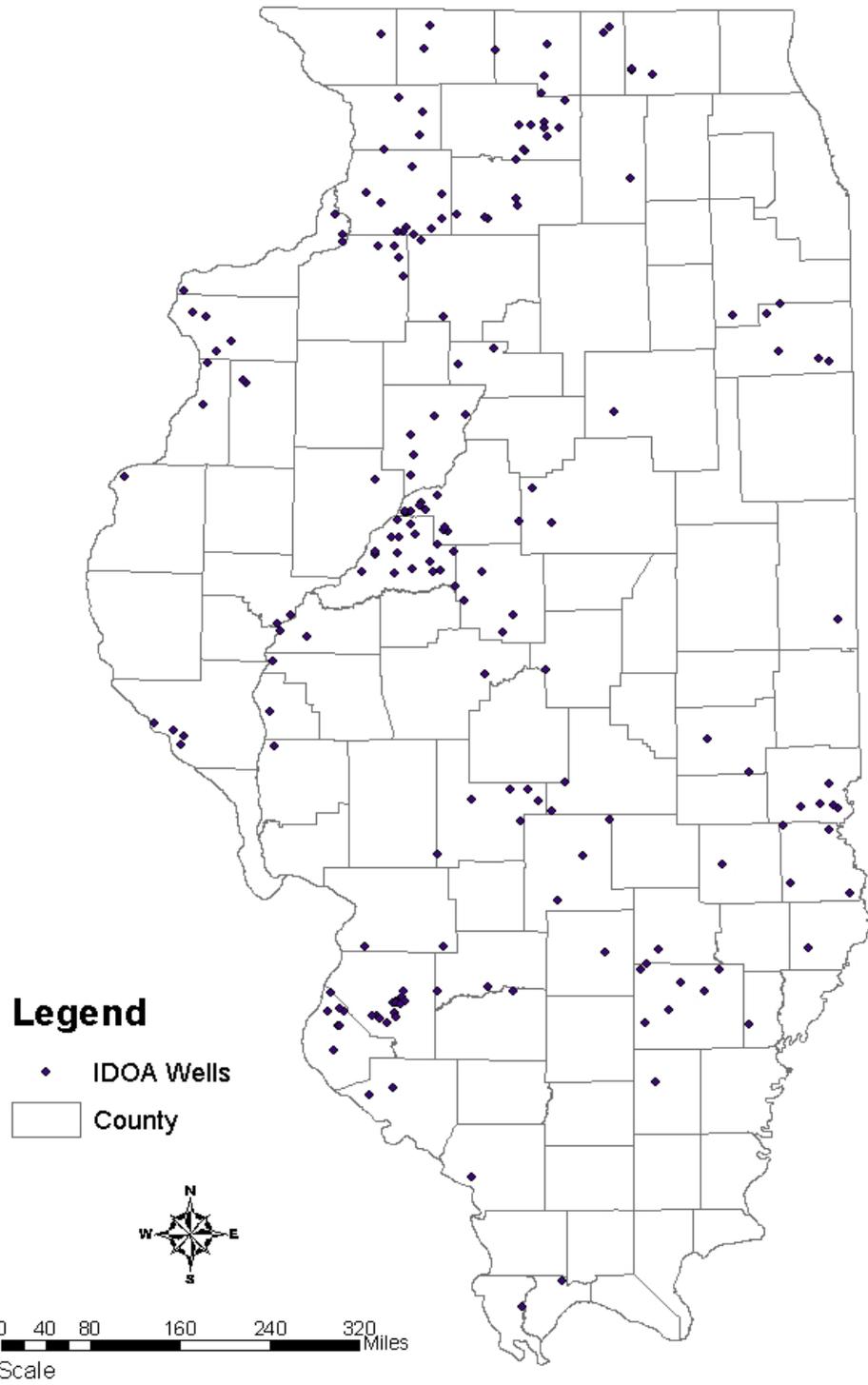
The network consists of 170 shallow groundwater monitoring wells located throughout the state, see Figure 3. Well depths vary from 10 to 87 feet. Wells are constructed of 2-inch inside diameter, polyvinyl chloride (PVC) well casing with a 5-foot long slotted PVC well screen. Each well is located in public rights-of-way adjacent to row-crop fields. All of the network wells are installed in areas mapped by Keefer (1995a, b) as being excessive, high or moderate in aquifer sensitivity and excessive, moderate, high or moderate, somewhat limited or limited, very limited in pesticide leaching class. An additional 10 wells were installed in areas of no known aquifer materials or no potential to store or conduct significant groundwater yields and are considered non-target monitoring wells. The areas for these ten wells are mapped as being very limited in aquifer sensitivity and moderate, somewhat limited or limited and very limited in pesticide leaching class. These 10 wells are not monitoring the same target aquifer materials and therefore are excluded from analysis with the primary 170 wells.

As part of a one-time sampling program from September 1998 through August 1999, 117 network wells were sampled. Samples were analyzed for the presence of 14 pesticides and 10 inorganic compounds. The overall weighted frequency of occurrence was 15.9 percent (Figure 2). The overall frequency of occurrence refers to the detection of any pesticide, or multiple detections, from a single groundwater sample. For example, the occurrence of two pesticides detected in a single well sample at concentrations above the minimum reporting level is considered a single detection for the purposes of this program. Data from the time-series sampling indicate that the overall frequency of occurrence of pesticides was greater in the period from June to October than in the other months.

Figure 2. Occurrence of pesticides in subunits mapped by Keefer (1995a, b) during sampling conducted September 1998 through August 1999 (Mehnert and others, 2001) and September 2000 through August 2002.

Aquifer sensitivity	Soil Pesticide leaching class	Depth to uppermost aquifer materials (ft)	Subunit	Subunit area as proportion of total area in state with aquifer material within 50 feet of land surface	Number of samples 1998-99	Frequency of occurrence 1998-99	Number of samples 2000-02	Frequency of occurrence 2000-02
Excessive	Excessive	< 20	1	0.027	19	0.158	25	0.0
	Moderate	< 20	2	0.176	22	0.273	27	0.037
High	Somewhat limited or limited	< 20	3	0.294	22	0.227	33	0.152
	Excessive	20 to 50	4	0.012	15	0.067	18	0.056
Moderate	Very limited	< 20	5	0.218	22	0.182	25	0.040
	High or moderate	20 to 50	6	0.274	17	0.0	30	0.067
Totals/Weighted Frequency of Occurrence					117	0.159	158	0.079

Figure 3. Illinois Department of Agriculture Dedicated Pesticide Monitoring Network Wells



In 2000, the Department decided to shift the emphasis of the monitoring network from time-series sampling of a relatively few wells to a long-term monitoring emphasis in order to support implementation of the state's Generic Management Plan for Pesticides in Groundwater. Under the sampling plan, each well in the network is sampled once during a two-year period to provide data on the occurrence of the selected pesticides in shallow groundwater. The IDA assumed responsibility for all sampling in July 2001. The IDA will continue to sample the entire network of wells in two-year cycles.

Results of the second-round sampling of the monitoring wells (158 samples collected between September 2000 and August 2002) indicate an overall weighted frequency of occurrence of 7.9 percent (Figure 2). Atrazine was detected in eight samples and two of those samples had concentrations (0.58 and 0.85 micrograms per liter,  $\mu\text{g/L}$ ) above the regulatory action level of 0.3  $\mu\text{g/L}$ . Bromacil, cyanazine, metribuzin and metolachlor were each detected in one sample, but none of those samples had concentrations above levels of regulatory concern.

### **Section 7. Review and support the annual groundwater education work plan**

The ICCG's Education Subcommittee continues to actively implement statewide groundwater educational efforts and has worked with the four Groundwater Protection Planning Committees to establish local groundwater programs. Most groundwater protection educational funding support is provided by DNR and by Illinois EPA through regional groundwater protection committees. The Education Subcommittee, chaired by the DNR, has conducted a program that addresses groundwater related topics to educate the general public, business, agriculture, government, and private water supply owners, users, and operators. The ICCG reviews and provides input on the Groundwater Education Work Plan.

### **Section 8. Evaluate the development of Class III Special Resource Groundwater for Dedicated Nature Preserves**

To date, two Dedicated Nature Preserves (DNPs); Parker Fen and Fogelpole Cave have been designated as having Class III Special Resource Groundwater (see Chapter 5 for more discussion). The ISWS and ISGS have worked on methods to estimate groundwater recharge areas and a draft report has been prepared that addresses the use of these methods by applying them to 12 DNPs including Parker Fen. It is expected that the Illinois Nature Preserve Commission will petition the Illinois EPA to designate the groundwater recharge areas associated with the 11 additional DNPs as Class III Groundwater.

## **Section 9. Review regulated recharge area proposals**

The GAC in conjunction with the ICCG were required to develop an integrated groundwater and surface-water resources agenda and assessment report. See Chapter I, Section 1 for further information.

Effective September 1, 2001, Pleasant Valley Public Water District (PVD), in Peoria County, became the state's first regulated recharge area in the state, a defined area with specific regulations in place to protect vital groundwater resources. The GAC assisted in the adoption of the Pleasant Valley Public Water District regulated recharge area during the 2000 through 2002 reporting period. No additional proposals were received this reporting period. However, the GAC will assist in future regulated recharge area proposals as they occur.

## **CHAPTER II. GROUNDWATER ADVISORY COUNCIL OPERATIONS**

### **Section 1. Per the request of the Governor's Office, review and make recommendations regarding groundwater quantity issues for the next legislative session**

A comprehensive discussion of groundwater quantity issues is included in Chapter I, Section 1, "Assist the GAC in the review and development of recommendations pertaining to groundwater quantity issues."

### **Section 2. Conduct policy related meetings**

The GAC conducted several policy related meetings over the past two years. The GAC is comprised of nine members who represent public, industrial and local government interests. The IGPA mandates that the council members be appointed by the governor to serve three-year terms. The current members are as follows:

- Bill Compton (Chair) - Business Interest (Caterpillar, Inc.)
- Dennis Duffield - Public Water Supply Interest (City of Joliet)
- Jack Norman - Environmental Interest (Sierra Club)
- George Czapar - Agricultural Interest (University of Illinois – Extension)
- Paul McNamara - Local Government Interest (Southwestern Illinois Planning Comm.)
- Robert Miller - Business Interest (Industry Consultant)
- Dennis Dreher - Regional Planning Interest (Northeastern IL. Planning Comm.)
- John Liberg - Water Well Drilling Interest (Illinois Association of Groundwater Professionals)
- Robert Kohlhasse - Environmental Interest (Farnsworth Group)

### **Section 3. Provide input to programs, plans, regulatory proposals and reports as appropriate**

*Pleasant Valley Public Water District* – The GAC assisted in the adoption of the aforementioned Pleasant Valley Public Water regulated recharge area during the 2000 through 2002 reporting period. As noted, no additional proposals were received this reporting period, however the GAC will assist in future regulated recharge area proposals as they occur.

### **CHAPTER III. EDUCATION PROGRAM FOR GROUNDWATER**

#### **Section 1. Coordinate and conduct a statewide education program with an annual evaluation and work plan involving local, regional and state organizations and agencies. Support the integration of groundwater protection into state and local agency educational programs**

While recognizing this is an ongoing program, this goal has been achieved. Statistical data presented in Appendix III of this report documents the extent of achievement and results of a survey to assist in completing an evaluation.

The annual work plans were developed by the Education Subcommittee of the ICCG and transmitted to the ICCG and GAC for review and approval. The two work plans in this biennium coordinated the educational work of almost 30 agencies, 20 associations, and 11 committees representing certain geographic areas or groundwater constituencies. Each work plan addressed five audiences: the general public, well owners, water professionals and officials, business, and Illinois teachers. Each audience was addressed by a section of the work plan, which itemized materials and services planned, the lead agency or association, a planned completion date, and a progress reporting mechanism. Several planned projects were not completed, due to limited staff or financial resources.

Each year, completed projects were moved to the accomplishments section of the work plan, which has become lengthy over the 16 years since the IGPA was enacted. Since many of the short term training projects and publications (numbering 126) have been completed, the work plan now is laced with “ongoing” services, though many of the publications and audiovisual materials need to be improved and updated. A recent update of the DNR brochure listing groundwater education materials found in the Groundwater Education Materials (GEM) Center shows almost eighty publications, posters, and audiovisual programs from over 20 sources which are available for free distribution or loan. Approximately 100,000 pieces per year are distributed through the GEM Center, many in packets prepared for specific audiences or to primary distribution points, such as local health, water, University of Illinois (UI) Extension, or soil and water conservation district offices. Of these 80 publications more than a third were recently judged to be aging and in need of updating. The UI Extension Service and IDPH are credited with consistently keeping their publications fresh and up-to-date with recent relevant information such as code changes.

The ISGS added a new groundwater publication, *Groundwater: a Vital Illinois Resource* (Killey and Larson, 2003). This publication is meant for a general audience.

Since 1988, the annual work plans have evolved a great deal. Originally the education program was aimed at informing water officials and professionals about the various provisions of the law. A speaker's bureau actively aided community service organizations in identifying groundwater speakers. The Groundwater Science Award system was established with the Illinois Groundwater Association (IGA) to recognize applications of this emerging, young science, especially related to protection of groundwater resources. Three statewide workshop series were conducted to bring current program information to professionals.

As various elements of the IGPA were institutionalized and rules adopted, emphasis has switched to communities, regionally sponsored events, well owners, Illinois teachers, and their students. Regional field days emphasize local groundwater protection challenges and opportunities, and the Shining Star Awards Program identifies and promotes community successes. Agencies and associations cooperate in staffing a Water Well Clinic at the two Illinois state fairs where well owners get professional advice about their private water supplies.

Probably the greatest deterrent to sound groundwater protection programs is a lack of understanding of groundwater science, as revealed in interviews with well owners and educators. Groundwater is out-of-sight and out-of-mind. When most Illinois citizens were in school, groundwater was not taught as part of the water cycle, nor were its vulnerability to contamination, its vital role in the health of Illinois citizens, nor its terribly undervalued importance to the Illinois economy. In the long term, this deterrent can be overcome through:

- incorporating groundwater as part of the water cycle in the school curriculum;
- developing and providing teachers with groundwater hydrology teaching methods and models, preferably through county or regional workshops;
- using local or Illinois examples of groundwater problems and solutions (a balance of both "scare" stories to get citizens' attention, and "success" stories to show rational, science-based protective practices or solutions);
- providing localized or personalized source water or contaminant information (which can be made available at internet speed.);
- utilizing local groundwater contamination problems as a springboard for exposing and elevating groundwater into locally adopted land use controls and curricula;
- maintaining a unified educational approach involving Illinois State Board of Education and appropriate agencies (largely assured by IGPA, ICCG, and GAC).

Consequently, the work plans now emphasize longer-term groundwater education programs. Approximately 120,000 public and private Illinois teachers are targets for the message that groundwater must be integrated into teaching about the water cycle and this can be integrated into local community water issues. As detailed in Section III below, pre-service teacher competency requirements relating to water and health have been strengthened. If provided with proven teaching methods and improved teaching equipment, teachers currently in service can readily understand, teach, and demonstrate groundwater science. The teacher-pyramidal effect is illustrated in that most science or health instructors teach at least a hundred students a year over a thirty-year career. By reaching 20 young teachers, we may influence the education of over 60,000 Illinois citizens.

During this reporting period, regional groundwater committees placed heavy emphasis on teacher workshops at the county level, with locally generated funding. Over \$40,000 was raised from local sources to provide teachers with materials and models in a workshop setting sanctioned by a regional office of education for in-service credit. Funding came from a wide variety of sources, including local businesses, regional committees, service clubs, water utilities, farm organizations, soil and water conservation districts, counties, foundations, and well drillers. Each workshop aims to develop (and reward) mentor teachers to conduct the workshop, carry on the work and assist new teachers. Another goal is to develop connections between teachers and their local health, water, UI Extension, and natural resource agencies. Evaluations of these workshops have helped improve them and have been very positive.

Since 1991, the Groundwater Education Program has placed a high value on securing groundwater flow models in schools. Typically, during a day-long workshop, teachers are provided an empty 1' high by 2' wide by 1" thick ant-farm-like shell and a profile representing local geology obtained from well logs. With guidance, teachers then pack the models with sand, gravel and clay representing local underground conditions. Aside from developing a sense of ownership, local geology, and scientific methods related to groundwater, teachers also save their school district several hundred dollars through this do-it-yourself, model building activity. There are over 5,600 public and private attendance centers (schools), of which 800 are equipped with a groundwater model. Thus, only one in seven Illinois schools have the model available. In state priority areas (16 counties), an estimated two-thirds of the schools now have groundwater models.

Due to immense teacher turnover in the past 10 years, many newer teachers were found to be unaware of the groundwater model in their school or of its great educational demonstration capabilities. Consequently, all four regional committees have taken steps to refresh models and retrain teachers in groundwater workshops. Special maintenance and rebuilding workshops were also conducted at various meetings of science and agriculture teachers.

In summary, 16 years after the adoption of the IGPA and this education program, great progress has been made at overcoming deterrents to groundwater protection, but mostly in the 16 counties targeted by the Priority Groundwater Protection Planning Regions. In these counties, middle school teachers were targeted for workshops, hundreds of groundwater flow models were built, and local technical support was developed and applied. As new groundwater protection committees are organized in Illinois' remaining 86 counties, and as financial and staff resources are developed, this program can provide similar services to them. Through efficient use of time at field days, groundwater staff reached students and teachers in over 50 counties representing almost 10 percent of this statewide audience. The Groundwater Protection Education Program has successfully adapted to changing needs, helped to integrate groundwater protection into existing programs, and secured the participation of many agencies and associations, but primarily in the limited target areas.

## **Section 2. Support regional groundwater protection committees with special education programs based on regional needs. Emphasize programs for wellhead protection involving local water, planning, and health authorities**

In addition to supporting education programs in the Northern, Northeastern, Central, and Southern Regional Groundwater Protection Planning Committees (which are highlighted in Chapter 7 of this report), this program supports others as well. The Mahomet Aquifer Consortium members made several applications for educational funding and supported teacher workshops at Parkland College. A groundwater education committee was developed to cover Shelby and Christian counties and it was expanded to include the part of Macon County in the strip aquifer near Blue Mound and Macon. Finally, a consortium of groups involved in the Piasa Creek Watershed Project and served by Lewis and Clark College, developed a Water Celebration and Teacher Training Committee.

Starting in 1993, groundwater education workshops (utilizing groundwater flow models and the H<sub>2</sub>O Below activity book for middle school teachers) were conducted for teachers in designated priority counties. The activity book and teaching methods were developed through a W.K. Kellogg Foundation grant of \$500,000 to Southern Illinois University at Edwardsville. When the grant expired in 1998, teachers in the original 11 counties had been provided with materials, training, groundwater models and mentoring. After the grant expired, the project was continued at the local level with strong support of the regional groundwater committees, regional offices of education, DNR, Illinois EPA, Illinois Farm Bureau, and many supporting agencies and associations. The Northeastern Regional Committee found resources to cover their four counties and several adjoining counties within the jurisdiction of those regional offices of education.

A groundwater workshop including model building was completed for 12 teachers in Pulaski, Johnson, Union, Alexander, Massac, Pope, and Hardin counties. A workshop for 15 teachers and water operators from Shelby, Christian, and parts of Macon counties was completed in 2003. The Northern Regional Committee conducted a model-rebuilding workshop for teachers from Boone, McHenry, and Winnebago counties in 2002. Finally, the Lewis and Clark College team built and placed about 25 models in schools in Calhoun, Jersey, Macoupin, Greene, and Madison counties. Each program was a series of several development meetings culminating in a workshop with trained local teachers and water mentors using classroom-tested activities to teach middle school teachers. Each participating teacher created a groundwater flow model representing the hydrogeology under their community, and identified local health, water, planning and community education professionals. Altogether, teachers in 25 counties have had opportunities to build groundwater models in a locally sponsored workshop setting.

### **Section 3. Through educational institutions and organizations, curriculum projects, and teacher workshops, integrate groundwater principles and groundwater protection into the curriculum for grades 3-12, emphasizing correlation with Illinois Learning Standards**

Since the Illinois State Board of Education (ISBE) adopted Illinois Learning Standards in July of 1997, the process for integrating groundwater principles into the curriculum has become considerably easier since there is clear direction on when various topics are taught in the schools. Specific Learning Standards that apply directly to groundwater protection education are listed below:

*Goal 11* – Understand the processes of scientific inquiry and technological design to investigate questions, conduct experiments and solve problems;

*Goal 12* – Understand the fundamental concepts, principles and interconnections of the life, physical and earth/space sciences;

*Goal 13* – Understand the relationships among science, technology and society in historical and contemporary contexts;

*Goal 16* – Understand events, trends, individuals and movements shaping the history of Illinois, the United States and other nations: E. Understand Illinois, United States and world environmental history; and

*Goal 22* – Understand principles of health promotion and the prevention and treatment of illness and injury.

Since these standards cover the areas of science, social studies, and health education, there are ample opportunities for integrating the relatively new science of groundwater in various areas and working across disciplines. In 2002, the ISBE greatly assisted the cause of groundwater education by including specific groundwater references in performance descriptors. An example follows of a groundwater specific science descriptor at the high school level for Goal 12 B (Students will be able to know and apply concepts that describe how living things interact with each other and with their environment).

Apply scientific inquiries or technological designs to research the sustainability of water resources by:

- sketching and quantifying the hydrologic cycle locally and globally, or
- simulating water supply recharge/deficit/surplus and groundwater infiltration, or
- modeling effects of point source and non-point source pollution, or
- explaining water and sewage treatment.

One sampler assessment specifically involves methyl tertiary butyl ether (MTBE) contamination at a community water supply. Students are asked to investigate and role-play at a town meeting where MTBE contamination of the community water supply is being addressed.

A very similar situation of MTBE contamination is embodied in *HEALTHY WATER–HEALTHY PEOPLE*, the new national Project WET (Water Education for Teachers) Educators’ Guide. This can be found in a grades 9-12 student activity entitled “Setting the Standards,” and

simulates the process used by state agencies, such as Illinois EPA and Illinois Pollution Control Board, for setting water quality standards. The properties of MTBE are reviewed as part of the risk assessment process.

In June 2003, ISBE adopted standards for “highly qualified” teachers under the Federal “No Child Left Behind” Act. This federal law requires all teachers of core subjects, such as science or geography, to meet competency requirements by the 2005-2006 academic year. These requirements were previously adopted in the year 2000, in a hefty document entitled *Content Area Standards for Educators*. Laced through the core standards for all science and geography teachers are the requirements that competent teachers must understand the dynamic nature of Earth and its water cycle and explain and apply it in real-life situations. Earth and Space Science Specialists have additional knowledge and performance requirements related to accessing and analyzing water supply data, conservation, and protection of water resources. Competent health teachers must understand and apply environmental and community health principles to prevent illness and promote public health. These standards and competency requirements will be used by teacher training institutions to define the training of future Illinois teachers.

To support existing teachers, presentations and exhibits were made at all meetings of the Illinois Science Teacher’s Association and some regional or county teacher institutes. During this biennial period, about 4,500 groundwater posters, 1,500 rain gauges and 4,000 hydrologic budget meter sticks were distributed at these events. In each presentation the concepts of local recharge, water testing, and soil as a groundwater filter were presented. All new materials produced have referenced appropriate Illinois Learning Standards.

Two curriculum development projects were developed specifically in and for Illinois related to groundwater. *Groundwater: Illinois’ Buried Treasure*, was developed (and last revised in 1993) by the Environmental Education Association of Illinois and DNR. About 900 of these K-12 activity guides are distributed each year to teachers or youth leaders who request them or who participate in workshops where groundwater models are not being built. For teachers with groundwater flow models, *H<sub>2</sub>O Below: An Activity Guide for Groundwater Study* was developed by the Illinois Middle School Groundwater Project (and last revised in 1997). This 238-page book is provided free to teachers who participate in workshops where groundwater flow models are built or to teachers who request them.

Besides the Buried Treasure and H<sub>2</sub> O Below curriculum projects developed through this program, the national Project WET (Water Education for Teachers) cooperative curriculum (coordinated in Illinois by DNR) was integrated with the teacher training workshops whenever possible. The Project WET curriculum has several excellent groundwater learning activities, which teachers find very useful and can easily be adapted to Illinois conditions. Groundwater staff assisted in the development of *HEALTHY WATER–HEALTHY PEOPLE*, discussed above, a new WET project aimed at testing and protecting drinking water. Pending funding, this will be introduced to Illinois teachers in FY 04, first through facilitator training and then through integration with WET workshops for teachers.

**Section 4. As groundwater recharge maps are published for community water supplies, provide educational programs to improve understanding and to develop community actions involving teachers and students**

The Illinois Rural Water Association's (IRWA) program of technical assistance to small community water suppliers, with U.S. EPA and Illinois EPA funding, has provided support to many smaller communities in developing their source water protection programs. A five-step program is established which results in a local source water protection plan being developed with community outreach and input. Following educational and technical assistance, largely from IRWA and Illinois EPA, over 100 communities have adopted maximum setbacks protecting more than 315 water supply wells.

Illinois EPA compiled a summary comparison of groundwater protection ordinances from seven Illinois communities, a very helpful educational and ordinance advocacy tool. It is distributed with a detailed 148-page manual entitled, Groundwater Protection by Local Government, developed by the Illinois Section of the American Planning Association and the University of Illinois with support by Illinois EPA and DNR. An accompanying University Extension Land and Water Circular #18, entitled Community Water: How Local Communities Can Protect their Water, is distributed freely to community leaders at meetings of the Illinois Municipal League, Township Officials of Illinois, and the Illinois Association of County Board Members.

Gardening in Your Capture Zone, a brochure offering "do's" and "don'ts" related to home activities and BMPs was published by DNR for free distribution both to homeowners with private wells and to residents living within community well capture zones. The brochure refers readers with specific questions to local water, health, extension, and soil and water conservation district offices.

Several communities have developed education programs specifically for landowners and businesses located within their wellhead protection areas. Businesses have been provided Pollution Prevention Interns in some areas and educational seminars or workshops in others. In East Dundee and Crystal Lake, volunteers from schools and senior service organizations canvassed these areas, provided information to residents, and reported findings to the municipal governing board. In a number of communities utilizing the American Bottoms aquifer, students stenciled water quality reminders on storm sewer inlets. In still other communities, local media and websites featured groundwater protection maps and initiatives. In East Peoria, a high school geographic information systems class assisted the city public works department with global positioning system mapping of infrastructure, wells, potential sources, and potential routes in the delineated capture zone for its community water supply.

At the annual meeting of the Illinois Municipal League, community water and public works officials are presented with Shining Star Award information as models for groundwater protection. They are also provided specific information on source water protection for their community. Staff are surprised at how few of the officials have seen capture zone maps or heard of setback ordinances for wells in their own community. This lack of knowledge can be attributed to the rapid turnover in elected officials and that many persons attending this conference are recently elected.

**Section 5. Organize and conduct educational programs for private well owners, involving licensed water well contractors, local health departments, SWCDs, University of Illinois–Extension offices, and other organizations. These programs will address well abandonment, nutrient and pesticide management, wellhead protection, disinfection, testing, operation and maintenance methods**

Working through soil and water conservation districts and with support from Illinois EPA, the IDA and UI Extension secured and promoted the 116-page manual HomeACRE, which provides a voluntary evaluation of home health and environment. Thousands of copies have been distributed through workshops and other events. Field events on participating farms and water testing kits have often been incorporated into these events.

Health agency, water association, and DNR staff during 20 days of the two state fairs staffed groundwater protection exhibits and water well clinics. Private well owners, often with children, are the primary audience and they appear to be very appreciative of the advice and materials that are distributed. The IDA has also installed a groundwater protection display and three model wells in the new Watershed Park at the Springfield State Fairgrounds.

The Illinois Water Well Sealing Coalition (IWWSC), consisting of about 30 organizations and 10 agencies, strongly advocates the sealing of abandoned wells. Well sealing demonstrations were conducted in over 90 counties through DNR grants to the Association of Illinois Soil and Water Conservation Districts, starting in 1993. Recently, the Coalition developed a policy statement and legislative proposal to secure state cost-share, administrative, and educational funding to seal abandoned wells. In response to a resolution of the Association of Soil and Water Conservation Districts, the IDA included well sealing as an approved cost-share practice in its docket of conservation practices. However, no additional funding was provided until FY 2004, when almost \$200,000 was allocated for this practice.

Other exemplary well sealing programs continue throughout Illinois. Jasper County developed their own modest cost-share program and secured demonstrations of well sealing in each township of the county. Piatt County also allocated local funds. Lockport Township secured Community Development Block Grant funding and paid a contractor to locate and seal over 350 abandoned wells in the immediate vicinity of its community wells. The city of Loves Park, Winnebago County Health Department, Northern Groundwater Protection Planning Committee, and a water well contractor have cooperated to seal scores of wells in Loves Park. In the central portion of the state, the Mahomet Aquifer Consortium has compared well sealing policies and encouraged well sealing among its members. The Illinois Section American Water Works Association (ISAWWA) featured well sealing as part of its annual program in March 2003 and

supported the adopted IWWSC policy. The IWWSC website has been maintained at: <http://dnr.state.il.us/orep/inrin/eq/well/trial.htm>. The Illinois Association of Groundwater Professionals (IAGP) with IDPH support conducted training for licensed water professionals including pump installers, water well contractors, plumbers, and non-community public water supply operators (see Chapter 8 for complete summary). Recently passed legislation requires six hours of IDPH approved continuing education for each group related to water well and pump procedures. Three key websites designed for private well owners provide very useful and printable information on well construction, testing, maintenance and protection, as follows: National Groundwater Association ([www.wellowner.org](http://www.wellowner.org)); IAGP: ([www.iagp.org](http://www.iagp.org)); Illinois Department of Public Health ([www.idph.state.il.us](http://www.idph.state.il.us)).

#### **Section 6. Support field days and demonstrations conducted by SWCDs under the Illinois Water Well Abandonment Program**

During this reporting period, approximately 12 well sealing demonstrations were conducted by county or regional health, extension, soil and water conservation district, and regional groundwater committee entities, usually as a cooperative effort. The groundwater protection education program supplied exhibits, training, brochures, and contacts with water well contractors, as requested. Bentonite chips were used in most of the well sealing demonstrations for a hands-on demonstration. Education staff also participated in Illinois Water Well Abandonment Program (IWWAP) training meetings developed by IDA for local SWCD and environmental health staff, providing useful demonstration techniques and models. Also, Shining Star Awards were presented to three organizers of local well sealing programs, and these success stories provide models for other local units of government.

#### **Section 7. Maintain an easily readable and useful newsletter and closely related electronic bulletin board for communication with newsletter editors, communicators, water professionals, committee persons, educators, and agency representatives with groundwater protection interests. Secure interesting articles from these clients for publication**

Due to budgetary and staffing limitations the Groundwater Gazette has not been published since May 2000. Information is distributed through state, regional and local association newsletters, e-mails, list servers, web pages, and committees, as needed and appropriate. If and when constraints are eased, a high priority would be placed on electronic rather than paper media for distribution of information. A number of association or agency newsletters would be targeted for groundwater protection information.

## **Section 8. Secure funding to continue the Illinois Middle School Groundwater Project and other educational projects identified in the annual work plan**

Although some funding proposals were turned down, the regional groundwater committees have supported and secured support for the continuation of this program. During this biennial period, these projects were completed for teachers in 12 additional counties and started in one more. The regional offices of education, local health departments, soil and water conservation districts, water and wastewater utilities, farm organizations, and well contractors have supported the project with funding and staffing resources. When major funding was available through the W.K. Kellogg Foundation, four or more counties and 250 teachers were addressed each year, but now with very limited funding, two to six counties and 50 or fewer teachers per year are provided this service.

The DNR and Illinois EPA provided financial support for the Project WET, and a Project Environmental and Nature Training Institute for Conservation Education (ENTICE) workshop was conducted cooperatively with the Pleasant Valley Public Water District utilizing WET and H<sub>2</sub>O BELOW activities. Finally, the Mahomet Aquifer Consortium and Macon County SWCD have committed limited funding and resources to help develop groundwater educational programs for schools in their areas.

## **CHAPTER IV. GROUNDWATER EVALUATION PROGRAM**

### **Section 1. Continue to improve the Source Water Assessment Program Geographic Information System to include more interactive features**

Section 1453 of the federal Safe Drinking Water Act (SDWA) required states to develop and implement Source Water Assessment Programs (SWAP). The Illinois EPA established a Source Water Protection Technical and Citizens Advisory Committee to provide guidance in the development of our application. The U.S. EPA provided Illinois with this grant in 1997 and approved Illinois SWAP on October 28, 1999. The approval also included an 18-month extension for completing the SWAP in May of 2003. Illinois' approved SWAP committed to the development of an Internet GIS for providing source water assessment information to the public as required under §1453 of the SDWA.

### **Section 2. Continue to share Geographic Information System coverages in an electronic format and continue to automate the groundwater resource database for Illinois**

To facilitate cross-referencing between water well databases at the ISGS, ISWS, IDPH, and Illinois IEPA, the ISGS entered American Petroleum Institute (API) well identification numbers for more than 6,000 community water-supply wells to the IDPH, Illinois EPA, and ISWS databases. During this project, valuable locational data also were added to the ISGS database.

The Illinois Natural Resources Geospatial Data Clearinghouse (Illinois Clearinghouse) provides Internet access for no-cost, geographically-referenced digital data and imagery for Illinois. The on-line data holdings can be used to support a variety of GIS and remote sensing applications. The Illinois Clearinghouse, <http://www.isgs.uiuc.edu/nsdihome/>, is a multi-agency effort to make metadata and digital geospatial data about Illinois natural resources available on the Internet. The ISGS established and maintains the Illinois Clearinghouse, which has been on-line since July 1997. The primary goal of this effort is to foster a climate for the cooperative development of a statewide clearinghouse network in Illinois by promoting the advantages of the National Spatial Data Infrastructure (NSDI), a worldwide effort that promotes and supports digital data access and distribution.

Available data sets (with documentation) include: Digital Raster Graphics (DRG) files, Digital Orthophoto Quarter-quads (DOQ) files, geology, major bedrock aquifers, sand and gravel aquifers, Aquifer Sensitivity to Contamination by Nitrate Leaching, Aquifer Sensitivity to Contamination by Pesticide Leaching, land use, political boundaries, and more. A recent effort has involved scanning historic aerial photography from the 1930s/1940s and making the image files available via the Illinois Clearinghouse. The historic aerial photography was available by October 2003 for the following counties: Champaign, Cook, DuPage, Kane, Kendall, Knox, Lake, Marshall, McHenry, Peoria, Putnam, Vermillion, Will, and Woodford.

The Illinois Clearinghouse continues to attract considerable attention and download rates increase every month. During the first six months of 2003, the Illinois Clearinghouse recorded about 1,350,000 hits from 54,500 individual users. During the same period, about 60,500 DOQ files were downloaded from the Clearinghouse, a rate of more than 300 per day.

The ISWS, through funding from the Illinois EPA, has accelerated the placement of groundwater data in a web-accessible format. Following the lead of the Illinois EPA and United States Geological Survey (USGS) in the creation of the SWAP ArcIMS site, the ISWS has created an Information Management System (IMS) site currently containing 2001 water withdrawal data collected through the ISWS' Illinois Water Inventory Program (IWIP). These data include point water withdrawals (surface water and groundwater) for all community supplies and township aggregate withdrawals for self-supplied industrial, commercial, power generation, and wildlife management users. Plans include the addition of more years of IWIP data, ISWS groundwater quality data, and aquifer hydraulic properties data by the end of 2003.

### **Section 3. Continue to conduct groundwater assessments and share the information through regular updates and completed reports**

During the 2002 and 2003 reporting period, ISGS and ISWS scientists have been involved with mapping groundwater resources, assessing aquifer yields and recharge, and studying the occurrence, fate, and transport of contaminants in shallow groundwater. In May 2001, the 92<sup>nd</sup> Illinois General Assembly passed Senate Resolution 0137 and House Resolution 0365 directing the Department of Natural Resources to develop a plan for studying the aquifer systems of the state by November 2001. The Surveys prepared separate, but related, responses that focused on a comprehensive approach to water resources planning and management and how to achieve goals with limited resources for geologic mapping (ISGS, 2001) and water resources assessments (ISWS, 2001).

Groundwater resource availability is of particular interest in Kane County as a result of the Northeastern Illinois Planning Commission (NIPC) *Strategic Plan for Water Resource Management*, in which four townships in Kane County are predicted to have potential water shortages by the year 2020 if no action is taken. ISWS and ISGS scientists presented a one-day workshop on

#### Draft Water Supply Consortium Vision and Mission Statement

*Vision* - Recognizing that water resources have no political boundaries, the vision of the Tri-State Water Consortium is to ensure a sustainable high-quality water supply for future generations throughout the metropolitan region of northeastern Illinois, southeastern Wisconsin, and northwestern Indiana.

*Mission* - The Tri-State Water Consortium mission is to promote a comprehensive regional approach to sustainable water supply planning and management in the greater Chicago metropolitan region, including southeastern Wisconsin and northwestern Indiana. We recognize that comprehensive planning and management must include all water resources, from Lake Michigan to inland surface waters to groundwater. Our mission will address the tri-state region's water supply issues by pursuing the following goals:

- Acquire funding to support the mission of the Consortium;
- Promote water supply data gathering, research, and data analysis;
- Promote legislation at federal, state, and local levels for water supply planning and management;
- Advocate increased water supply education among all stakeholders;
- Create a regional water supply plan and provide support to implement that plan.

planning for a sustainable water supply to Kane County elected officials in March 2002. The workshop introduced a 5-year plan by the ISWS and ISGS, initiated in April 2003 and funded by Kane county, to map and assess the groundwater resources of Kane County. Numerous efforts are underway to map the county's groundwater resources (Sieving et al., 2003), create flow models of local aquifers in Kane county and regional aquifers of northeastern Illinois (Lin, 2003; Wehrmann et al., 2002), and assess the uncertainty of historical estimates of aquifer yield in northeastern Illinois (Meyer & Walker, 2002; Walker et al., 2003). New regional models of the deep aquifers in northeastern Illinois will incorporate the potentiometric surface prepared by Burch (2002). With a push toward greater use of shallow groundwater resources, the ISWS has studied the potential effects of urbanization on recharge rates (Meyer 2002 a, b) and water quality trends in shallow groundwater (Kelly & Wilson, 2002).

The Mahomet aquifer of east-central Illinois is also a high priority. Larson et al. (2003) recently completed studying the Mahomet and overlying aquifers in DeWitt, Piatt, and northern Macon counties. Herzog et al. (2003) created a geologic model of the Mahomet aquifer and overlying units for use as input for groundwater flow modeling. Roadcap and Wilson (2002, 2003) are combining separate sub-regional flow models of the Mahomet into one model of the entire aquifer from the Indiana state line to the Illinois River. Numerous studies are focusing on the occurrence of arsenic in Mahomet groundwater (Wilson et al., 2002). The ISGS, ISWS, USGS/Urbana, and DNR/Office of Water Resources continue to serve as technical advisors for the Mahomet Aquifer Consortium, which has sought funding and support to study the aquifer underlying east-central Illinois. (For more information, see: <http://www.mahometaquiferconsortium.org/>)

The ISGS and ISWS have continued studying the environmental effects of agriculture including pesticides in shallow groundwater (Mehnert et al., 2003), swine manure pits (Krapac et al., 2002), nitrogen in the shallow groundwater of an agricultural watershed (Mehnert et al., 2002), and agricultural impacts on karst terrains (Panno et al., 2003, 2002a). Numerous investigations are examining the use of oxygen and nitrogen isotopes to identify nitrate sources in groundwater (Hwang et al., 2002; Roadcap, 2003; and Panno et al., 2002c).

Techniques to improve data collection, analysis, and map display were developed. High-resolution seismic reflection appears to be well suited for defining sand and gravel aquifers within the Quaternary sediments. Recent advances in data collection (e.g., Larson and Pugin, 2002) allow more efficient data collection. Keefer (2002) has evaluated different approaches for including uncertainty in geologic maps. Walker and Roberts (2002a, b, c) are applying new techniques to aquifer test analysis for heterogeneous (including fractured) aquifers in Illinois.

Other geologic mapping efforts include descriptions of the Quaternary aquifers in DeKalb County by Vaiden et al. (2003) and in the MetroEast area by Smith and Vaiden (2002). The availability of coal resources and the proximity of abundant water resources for energy production were the subject of work by Lim et al. (2002). Finally, geochemical data for the shallow bedrock in Vermilion County were released (Mehnert and Dreher, 2003).

### **USGS Monitoring Programs**

Illinois River Basin National Water-Quality studies--As part of the National Water-Quality Assessment (NAWQA) Program, the USGS is assessing both the Lower and Upper Illinois River Basins (LIRB and UIRB, respectively). The NAWQA studies are designed to be active for four to five years with subsequent minimal data collections for about five to six years. First cycle high-intensity data collection is complete for both lower and upper NAWQA studies. Copies of a number of reports from either study are available. A summary report of the LIRB first cycle data collection is available (USGS Circular 1209); a similar summary of the UIRB first cycle activities (USGS Circular 1230) should be available December 2003.

Both LIRB and UIRB studies are currently in low intensity data collection (three stream/river sites sampled monthly and a subset of wells in alternating years). Cycle 2 for the LIRB begins with a new high-intensity data collection period in 2005. UIRB's cycle 2 active phase begins in 2008 or 2009.

### **Barrington Area Council of Governments**

In April 2001, the Barrington Area Council of Governments (BACOG) Executive Board initiated a Water Resources Initiative (WRI) and committee to study groundwater resources in the greater BACOG region for the purpose of identifying quantity, maintaining quality, protecting sensitive natural areas, and establishing a plan whereby future land development may be managed within limitations of water resources.

The study will cover the entire BACOG area, including unincorporated township areas, plus several miles beyond BACOG municipality boundaries. When complete, the report and associated baseline data, mapping of the aquifers, development and water consumption projections, and policy recommendations will be shared with the BACOG municipalities, townships and the public.

The BACOG area is comprised of seven villages and the unincorporated areas of four counties (Cook, Lake, McHenry and Kane) in an area of 90 square miles. It is entirely dependent on the shallow aquifer for all water needs of the approximately 40,000 residents and the maintenance of vast tracts of unique natural areas. The villages of BACOG recognize the importance and vulnerability of water supply and wish to maintain the quantity, quality and sustainability of this resource.

The environment and the population are intricately intertwined. The natural areas depend on the shallow aquifer for preservation of diverse ecosystems, and because local planning requires the utilization of well and septic systems, water resources must be protected for existing and future residents. Any threat to quantity or quality of the interconnected surface and aquifer waters would affect both sensitive natural areas and population. Potential threats include over-usage, pollution, high intensity uses and higher densities within or near BACOG borders, certain commercial/industrial uses such as peaker power plants, and increasingly high residential water consumption with little attention to conservation.

The project will analyze environmental data, establish a baseline of quantity and quality of resources and regional consumption, project water usage through build-out, inventory natural areas, identify potential threats such as overusage and contamination, develop planning policies to address water needs, and implement a public education program. The project will include:

- Comprehensive collection of environmental data such as well drilling logs, soils, surface water features, detailed watersheds, geology, topography, and other existing digital data (Status: most data collected, but this will be an on-going task of the project as new and refined data becomes available);
- Data management and mapping in the Barrington area geographic information system (BAGIS), an existing tool, and using specialized software (Status: as above);
- Estimates of current water usage and projections of future usage based on zoning, anticipated development and population growth estimates (Status: 95 percent complete);
- Development of new data such as aquifer mapping, water recharge and potential contamination areas, baseline water budget, projection of future development, and modeling of development effects on water resources, all under the guidance of hydrogeology consultants (Status: anticipated that several areas will be addressed in preliminary reports in 2004);
- Establishment of private well volunteer network within BACOG for measuring water levels, water quality, and other features of groundwater (Status: network in place with 60+ volunteers within BACOG; water level measurements completed; water quality sampling underway);
- Development of planning policies for water resource sustainability and protection of natural areas, such as possible additional protection of groundwater recharge areas (Status: anticipated for 2004-05); and
- Public education program emphasizing conservation, protection of natural resources, water quality safety, trends in building, water usage, waste management and pollution (Status: anticipated for 2005).

#### **Section 4. Continue to utilize innovative and cost effective methods to implement statewide groundwater quality monitoring**

The collection of high-quality chemical data is essential in assessing groundwater programs. The Illinois EPA utilizes routine monitoring data to determine if deterioration (or improvement) in water quality has occurred over time and space. In principle, this information will accurately represent hydrogeologic conditions at a site and enable an understanding of the dynamics of sub-surface aquifer systems. The Illinois EPA has determined that the practical elements of a viable long-term groundwater monitoring program should include:

- evaluation of hydrogeologic setting and program information needs;
- evaluation of well-performance and purging strategies; and
- execution of effective sampling protocols that include the appropriate selection of sampling mechanisms and materials, as well as sample collection, preservation and handling procedures.

The state of Illinois conducts many different water quality monitoring programs, including those designed to detect impairments to groundwater. Groundwater in Illinois is routinely monitored for biological, chemical contaminants and to some degree withdrawal rates.

Groundwater quality monitoring programs consist of fixed station networks and intensive or facility related surveys of specific pumping centers. The Illinois EPA operates an Ambient Network of Community Water Supply Wells (CWS Network) as well as a Rotating Monitoring Network.

The CWS Network is designed to:

- provide an overview of the groundwater conditions in the CWS Wells in Illinois;
- provide an overview of the groundwater conditions in the major aquifers in Illinois;
- establish baselines of water quality within the major aquifers in Illinois;
- identify trends in groundwater quality in the major aquifers in Illinois; and
- evaluate the long-term effectiveness of Clean Water and Safe Drinking Water Act program activities in protecting groundwater in Illinois.

From the experience gained from prototype networks, the Illinois EPA designed a long-term ambient groundwater monitoring network for community water supply wells. The design of this network was completed after consultation with the USGS and ISGS and ISWS. The Illinois EPA developed a random stratified network intended to represent contamination levels in all active CWS wells. The CWS well network is stratified by depth, aquifer type and the presence of aquifer material within 50 feet of land surface. Additionally, the network is based on a probability of occurrence that will provide a 95 percent statistical confidence in the data with an associated plus or minus 5 percent precision and accuracy level. In order to randomize the sampling schedule spatially and temporally, 17 random groups of 21 wells, with alternates, were selected from all the active wells in the state. Each of these 17 random groups is a sample period. To further assure maximum temporal randomization within practical constraints, the samples from each sample period are collected over a three-week period.

Network stations have been sampled within a fixed three-week timeframe bi-annually since 1996 (during 1993 thru 1994 and 1994 thru 1995, samples were obtained within a three week time frame, annually). Water quality parameters include: field pH, field conductivity, field temperature, field specific conductance, field Eh, field pumpage rate, inorganic chemical analysis, and volatile organic/aromatic chemical analysis. All laboratory analytical procedures are documented in the Illinois EPA Laboratories Manual (revised 1987).

Beginning in 1993, the Illinois EPA has operated a Pesticide Monitoring Subnetwork of the CWS Network. Initially, Illinois EPA tested all wells in the CWS Network for triazine and alachlor using immunoassay screening methods. However, in the 1998 monitoring cycle Illinois EPA discontinued the use of immunoassay. At this time, the Illinois EPA randomly selected 50 percent of the CWS Network wells that were then analyzed for synthetic organic chemicals (SOCs) using standard laboratory test methods, as documented in the Illinois EPA Laboratories Manual (revised 1987). In the year 2000 monitoring cycle, the remainder of the CWS Network wells were analyzed for SOCs. This rotation will be maintained in the future.

### **Rotating Monitoring Network**

The purpose of this monitoring network is to maximize resources and increase groundwater quality monitoring coverage at CWS wells. During the 1997 monitoring cycle, the Illinois EPA initiated a rotating monitoring network program. Due to funding limitations, the Illinois EPA was forced to evaluate the CWS Network monitoring frequency. Illinois EPA determined that the primary purposes of the CWS Network could still be realized by reducing the monitoring frequency of the CWS Network to a biennial basis.

The Illinois EPA is currently able to concentrate on specialized monitoring at high priority areas during alternate years. In 1997, monitoring was focused on concerns related to highly susceptible CWS wells. These wells were prioritized because of the detections of organic contaminants in treated water samples obtained during routine monitoring required by the Safe Drinking Water Act. During the 1999 monitoring cycle, attention focused on “new” CWS wells with little or no monitoring history. The 2001 monitoring cycle once again focused on collecting data on new CWS wells and a subset of the CWS Network wells for radon and pesticide metabolite analysis. The 2003 monitoring cycle focused on wells not previously sampled by the Groundwater Program and several areas with historical groundwater contamination issues. The Illinois EPA intends to maintain this rationale in the future.

### **Section 5. Begin assessing pesticide metabolites and other emerging contaminants of concern**

Herbicides in ground water study—Herbicides and their transformation products have not been extensively or routinely analyzed for in samples from the source groundwaters supplying the citizens of Illinois through public-supply systems. The USGS in cooperation with the Illinois EPA collected groundwater samples from 117 wells randomly selected from the CWS Network to determine the spatial extent of herbicides and their transformation products in groundwater supplied to the public through municipal systems. A brief report describing herbicide distribution and the relation of this distribution to hydrogeology, and land and herbicide use is planned to be available in spring 2004. (Appendix IV includes recently available USGS publications.)

### **Section 6. Continue to implement and improve overall groundwater quality indicators**

Quality Assurance/Quality Control Sampling—As described above, the Illinois EPA Groundwater Section regularly samples a network of public-supply wells in Illinois to evaluate trends in ambient groundwater quality. To assist Illinois EPA, the USGS conducts an annual quality-assurance review of their sampling program including calibration of water-quality meters as part of the USGS National Field Quality-Assurance (blind-sample) program and field observation of samplers. As resources allow, it is anticipated that this quality assurance review will continue.

## **CHAPTER V. GROUNDWATER QUALITY STANDARDS AND TECHNOLOGY** **CONTROL REGULATIONS**

### **Section 1. Evaluate dedicated Nature Preserves for Class III designation**

The Illinois Pollution Control Board (Board) has designated the area contributing groundwater to Fogelpole Cave, a Dedicated Nature Preserve (DNP), as Class III: Special Resource Groundwater. Under the authority of 35 Ill. Adm. Code 620.230 (Board's Groundwater Quality Regulation), Class III: Special Resource Groundwater can be established for: groundwater that is demonstrably unique (e.g. irreplaceable sources of groundwater) and suitable for application of a water quality standard more stringent than the otherwise applicable water quality standard specified; for groundwater that is vital for a particularly sensitive ecological system; or groundwater contributing to a DNP.

Fogelpole Cave DNP is located in the southern part of Monroe County, Illinois, approximately three miles north of Renault, Illinois. Fogelpole Cave is located in the karst area of the Illinois Sinkhole Plain. The Fogelpole Cave system is also the subterranean habitat of the federally endangered Illinois Cave Amphipod (*Gammarus Acherondytes*). The formal request to designate Class III groundwater at Fogelpole Cave was received from the DNR Nature Preserve Commission in April 2003. The Groundwater Section of the Bureau of Water at the Illinois EPA completed the review required and found the petition from the DNR to be technically adequate. The Illinois EPA published the preliminary listing in the May 2003 Environmental Register. The 45-day comment period ended with no comments. The Illinois EPA published the final designation, which was listed in the August 2003 Environmental Register.

### **Section 2. Evaluate the need to develop Class III: Special Resource Groundwater Standards**

The development of numerical Class III groundwater standards may not be necessary in all cases to protect sensitive natural areas that rely on the designated groundwater. In some instances, the non-degradation provisions of 35 IAC 620 may be adequate to maintain current conditions, and therefore protect water quality. The existence of the Class III designation at Parker Fen, located in McHenry County, led local officials to deny zoning in the Parker Fen recharge area, because of the potential impact on water quality. Current land use in the Parker Fen delineated recharge area yields groundwater that supports a high quality fen environment. By maintaining the land use, groundwater quality should not be affected. Even without more stringent standards, the designation of a Class III groundwater focused the need to maintain current groundwater quality.

While the maintenance of water quality at Fogelpole Cave might be adequate to protect the threatened Illinois Cave Amphipod, disappearance of this species from nearby caves in the area indicates more protective standards may be necessary. The Illinois EPA anticipates that research by the U.S. Fish and Wildlife Service on the Illinois Cave Amphipod will provide guidance for which groundwater constituents are critical to the amphipod's survival. The Illinois EPA will periodically contact the U.S. Fish and Wildlife Service to determine the progress of the amphipod research. Depending upon the results of the research, the Illinois EPA will evaluate appropriate standards to meet the needs of this designated Class III groundwater area.

### **Section 3. Develop proposed groundwater quality standards for emerging contaminants of concern**

The Illinois EPA continues to evaluate contaminants of concern for inclusion in the 35 Ill. Adm. Code 620. One such constituent is perchlorate. This rocket fuel component has been discovered in some states, but needs further evaluation to determine its occurrence in Illinois. Another constituent that may be considered is ammonia. While ammonia is not a health concern at the concentrations at which it has been reported, the greater health risk is the conversion of ammonia to nitrite and nitrate within the water distribution system. Further, the Illinois EPA's Toxicity Assessment Unit has been tasked with evaluating health advisory information for pesticide metabolites detected in CWS wells.

### **Section 4. Continue to implement and integrate the groundwater quality standards into environmental programs**

As part of the new groundwater standards development process, the Illinois EPA BOW will coordinate with the BOL to evaluate the impact of any new groundwater standard within all programs. Impacts within the BOW (e.g. TMDLs) will also be evaluated for consistency and workability for all programs.

### **Section 5. Continue to update and amend the groundwater standards to parallel the drinking water standards adopted by U.S. EPA**

Four constituents: uranium, radium 226, radium 228 and arsenic have had new Maximum Contaminant Levels (MCLs) adopted. The Groundwater Section of the BOW will propose amendments to 35 Ill. Adm. Code 620 (groundwater standards) for the above listed constituents that have been found in Illinois' groundwater. Radium and arsenic occur with some frequency in Illinois' groundwater. Therefore, a groundwater standard amendment consistent with the MCL will be developed. Uranium is not a constituent that has been regularly sampled in the past. Therefore, to determine if uranium has been detected in any groundwater statewide, the Illinois EPA will have to coordinate internally, and with other agencies, to determine if other monitoring programs have detected uranium in groundwater. The MCL for arsenic does not become effective until 2006. Therefore, the Groundwater Section may change the groundwater standard for arsenic at a later date, to more closely correspond with the effective date of the MCL.

## **Section 6. Continue to implement preventive notice and response programs and integrate with environmental programs**

The potential source identification and monitoring conducted as part of the “new wells program” provided significant new data that was incorporated into the source water assessment program (See Chapter 6 for more discussion). However, to date, the preventive notice and preventive response activities of 35 IAC 620.305, have not been applicable. Approximately 350 new wells (i.e. wells not previously sampled by the Groundwater Section) have been sampled since the last biennial report.

## **Section 7. Evaluation of activities located proximate to CWS where local groundwater protection management efforts are completed or in progress will be given priority**

One site proximate to community water supply wells has come into full compliance with 35 IAC 615/616, since the last biennial report. One site has had additional evaluation completed. The Illinois EPA issued a letter stating that the potential source in question may not be subject to 35 IAC 615/616, and no further action would be taken at this time. Two additional sites are being further evaluated to determine applicability of 35 IAC 615/616.

## **Section 8. Evaluation and compliance determinations for activities referred by permit programs will also be given priority**

The Groundwater Section continues to provide hydrogeologic expertise to other BOW programs. The BOW, Mine Pollution Control Program, Industrial Permit and Municipal Permit Sections continue to refer sites for hydrogeologic evaluation. Some sites are being evaluated when the permit application for expanding existing operations is received. However, as the time since the adoption of the 35 IAC 620 regulations increases, the number of sites with permits that must be renewed also increases. Compliance with groundwater standards is evaluated during the permit review process. Violation notifications are issued if a site has an exceedence of the applicable groundwater standards. If compliance commitment agreements cannot be reached the site is referred to the Attorney Generals office for enforcement.

## **Section 9. Continue cooperation between the Illinois EPA and the IDPH to provide statewide education seminars on the implementation of the technology control and groundwater standards regulations**

The Illinois EPA and IDPH continue to coordinate on a number of topics. The educational opportunities have been more site specific, or focused on small regional areas. The source water assessment fact sheets that go to the public via the IDPH in communities where the Groundwater Contamination Response Strategy has been employed are educational tools. While no formal presentation of the fact sheet information is required, presenting this information is a cooperative effort by the Illinois EPA and IDPH.

The Illinois EPA and IDPH cooperatively monitored private wells, and held several public meetings to explain the results. At one of the mine sites referred to the Groundwater Section, the Illinois EPA conducted private well monitoring to assure that the mine site had not adversely impacted private wells. Though not impacted by the mine, the Illinois EPA monitoring results indicated that a number of private wells in the area had naturally occurring levels of sodium and manganese that were of concern. The IDPH then provided additional sampling for area residents concerned about the private well water quality. The Illinois EPA and IDPH then held three public meetings at which citizens' concerns about their water quality were addressed.

## CHAPTER VI. WELLHEAD PROTECTION PROGRAM

### **Section 1. Continue to publish wellhead protection and assessment data at <http://www.epa.state.il.us/water/groundwater/source-water-quality-program.html>**

The Illinois EPA has implemented a source water assessment program (SWAP) to assist with wellhead and watershed protection of public drinking water supplies. The 1996 amendments to the federal Safe Drinking Water Act

Illinois ranked among the top states within U.S. EPA Region V for completing the assessments and providing them to the public to assist with implementing protection efforts, as follows:

State	Total CWS	Percent Complete
Illinois	1,802	98%
Indiana	865	16%
Michigan	1,468	0%
Minnesota	956	100%
Ohio	1,355	54%
Wisconsin	1,113	1%
<b>TOTAL</b>	<b>7,559</b>	<b>49%</b>

established several programs that will help water suppliers continue to provide safe, adequate and affordable water to their customers. As required by these amendments, the Illinois EPA, in cooperation with water utilities and other stakeholders, has developed and the United States Environmental Protection Agency has approved, Illinois' SWAP. The purpose of SWAP is to:

- Identify areas that supply drinking water to the public
- Inventory potential sources of contamination
- Determine the susceptibility of the source water to contamination
- Inform the public of the assessment results

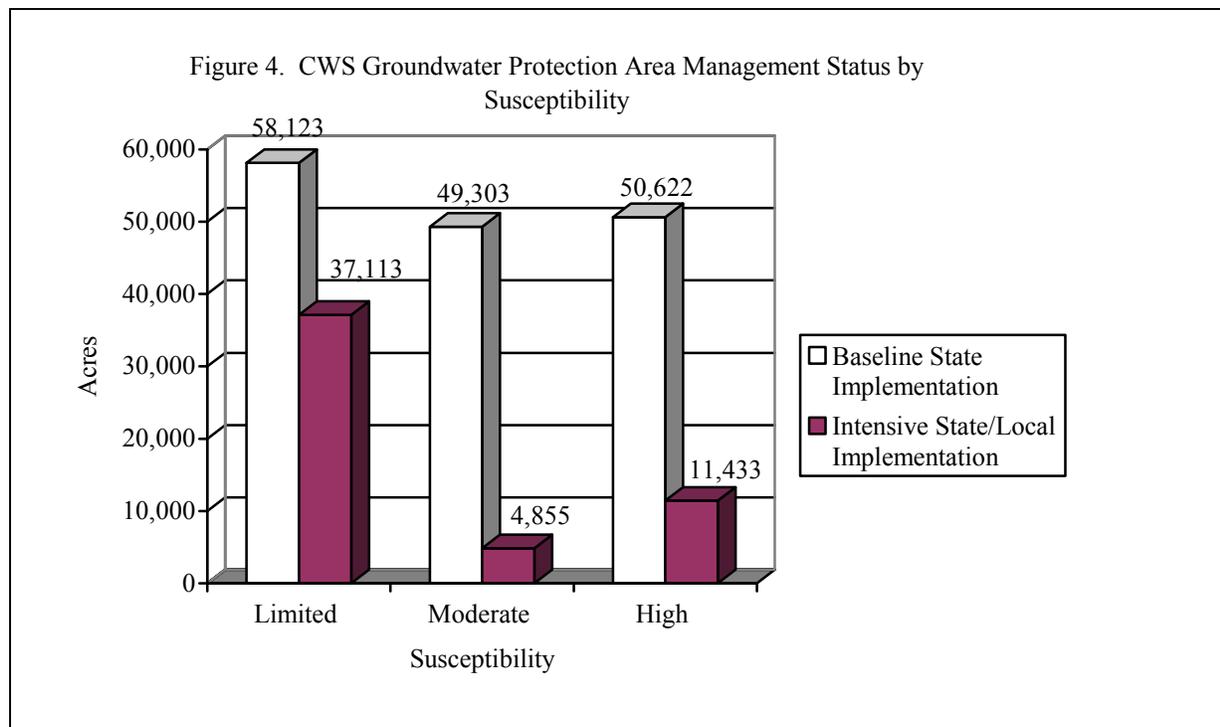
More than 11 million people in Illinois rely on public water supplies for drinking water. Assessments have been conducted for all public water supplies in Illinois, including approximately 1,800 community water supplies. In addition, more than 4,100 non-community water supplies have been assessed. Illinois SWAP activities were divided into the following areas: 1) community surface water supplies; 2) non-community surface water supplies; 3) Great Lakes (Lake Michigan); Community groundwater supplies; 4) non-community groundwater supplies; and 5) mixed ground and surface water community water supplies.

The Source Water Assessment Program, implemented by Illinois EPA, will help communities make important decisions about how to protect their drinking water. By working to ensure safe drinking water supplies, the health and economy of the community, as well as the preservation of natural resources, will be greatly improved. In addition, investment in drinking water treatment will be sustained for a longer time period.

Communities, whether using groundwater or surface water, should take an active role in the assessment of their drinking water supplies. To view a summary version of the Source Water Assessments, individuals can access the following Internet site: <http://www.epa.state.il.us/cgi-bin/wp/swap-fact-sheets.pl>. For Public Water Supplies, this summary information describes pertinent sub-sections of each completed assessment including: Importance of Source Water; Susceptibility to Contamination Determination; and documentation/recommendation of Source Water Protection Efforts. However, summaries of Source Water Protection Efforts have not been documented for non-community water supplies. It should be noted that these Source Water Assessment summaries are presented in strict compliance with Illinois EPA's security policy on the release of sensitive information. Therefore, all locational data and maps pertaining to wells, aquifers and/or surface water intakes have been removed.

**Section 2. Increase the percentage of intensive groundwater protection management for Community Water Supply Wells**

The Groundwater Section has compiled a “new” measurement tool to assist U.S. EPA Office of Ground Water and Drinking Water in collecting Source Water Assessment and Protection Program information, see Figure 4 below. Based upon the preliminary data acquired to this point, 3,456 SWAP areas representing 7,251 PWS wells and 209 PWS surface water intakes were evaluated. These areas make up approximately 3.95 million acres of the state’s 36.1 million total acres. Roughly 3 million of these acres represent high susceptibility SWAP areas associated with surface water sources.



Through the source water assessment and WHPP, the Illinois EPA identified 16,354 potential sources of contamination of which 1,163 are considered threatening. The most prevalent (common) potential source grouping was land disposal activities (2,953 sites) and the most threatening potential source grouping was chemical/petroleum processing/storage (255 sites) facilities.

### **Section 3. Develop and implement source protection criteria to use in the planning, construction and location of new community water supplies**

In the past two years, there have been approximately 100 new CWS wells permitted. The Illinois EPA continues to implement procedures to assist in the protection of these new wells. The overall goal is to promote locating new CWS wells in areas with a low potential for contamination and to encourage management practices that will minimize the potential for future contamination. As outreach efforts continue, the Illinois EPA acquires the necessary hydrogeologic information from CWSs adding new wells to their drinking water system. The information is then utilized to delineate source water protection areas for new wells utilizing unconfined aquifers. Upon completion of these delineations, the Illinois EPA provides technical support to CWSs wishing to initiate protection programs including maximum setback zones, overlay zoning pollution prevention (P2) and other groundwater BMPs.

### **Section 4. Continue integration and implementation of the WHPP under SDWA new alternative monitoring program**

The Illinois EPA continues to encourage local Well Head Protection Area (WHPA) management through the incentives provided by the SDWA vulnerability waiver program. Under the WHPP, a WHPA is defined and the potential sources of groundwater contamination are inventoried within this area. Following these steps, local stakeholders are involved in developing and implementing WHPA management plans. Given the natural geologic protection and/or management plans in these WHPAs, the vulnerability to contamination can be reduced or eliminated. To date, approximately 557 community water supplies have received a monitoring waiver through Illinois EPA endorsement of their WHPA management/protection plans.

## **Section 5. Finish the delineation of recharge areas for CWSs using reasonably available information**

The Illinois EPA has delineated the five-year recharge areas of CWS wells utilizing unconfined aquifer systems. Historically, completion of these delineations has focused on CWSs located within Illinois' Priority Groundwater Protection Planning Regions, and under a vulnerability monitoring waiver program as allowed by the SDWA to encourage groundwater protection program implementation. All unconfined supplies for which reasonably available data exists have had their delineations completed (see Appendix V). The total number of facilities with completed delineations is 217. In addition, in conjunction with the Source Water Assessment Program and with the assistance of the Illinois Rural Water Association, potential source inventories within the recharge areas have been completed. Coordination and technical assistance from the IRWA has also been provided to establish local teams for development of local groundwater protection programs. Further evaluation of available hydrogeologic data for other unconfined supplies is being conducted to determine the recharge area delineation potential for these supplies. New CWS wells continue to be evaluated and their recharge areas delineated as they are brought on-line.

## **Section 6. Modify CWS water well construction permit application procedures to include collection of information on potential sources and routes, well logs, pumping tests and chemical analyses**

Illinois EPA continues to promote wellhead protection by providing a copy of an informational pamphlet entitled "Wellhead Protection for New CWS Wells" to each facility making application for a new well. The purpose of this brochure was to encourage CWSs to obtain the data needed to take proactive steps to protect their source of water. By protecting their water source the CWS is able to protect the money invested in new well construction. The brochure explains the benefits of protecting new wells from certain nearby high-risk activities, and contains steps for the CWS to follow during the well permit procedure. The new well data will be used by the Illinois EPA to delineate recharge areas and provide technical assistance for establishing maximum setback zones and other protection programs.

## **CHAPTER VII. REGIONAL GROUNDWATER PROTECTION PLANNING PROGRAM**

### **Section 1. Current committee flexibility should be maintained while assisting with conducting and supporting both new and follow-up efforts of encouraging local and regional groundwater protection programs**

The Illinois EPA is the primary Agency responsible for implementing this groundwater protection goal. The Illinois EPA continues to work very closely with the regional planning committees to establish groundwater protection programs at the local level; however, these programs are very time consuming and significant work is needed in this area.

Section 17.2 of the Illinois Groundwater Protection Act (IGPA) requires the Illinois EPA to establish a regional groundwater protection-planning program. The Illinois EPA utilized recharge area mapping (completed by the Department of Energy and Natural Resources), groundwater pumpage data, population affected, water supply characteristics, solid waste planning efforts and other factors to select the four existing priority groundwater protection planning regions. A committee is appointed for each region by the Illinois EPA director and includes a cross-section of representatives from the region, including: counties and municipal officials; owners or operators of public water supplies which use groundwater; at least three members of the general public who have an interest in groundwater protection; and the Agency and other state agencies as appropriate.

The Groundwater Section continues to coordinate with the regional groundwater protection planning committees to implement programs and assist with targeting local contacts and interest groups. Each regional committee has adopted specific mission goals and objective statements to advocate groundwater protection practices and procedures to municipal, county, state and other local units of government throughout their respective regions. These goals and objectives are useful in the prioritization and development of local groundwater protection programs, many of which are described in this chapter.

Although each region has specific priorities and areas of concern, their mission statements all have common goals and objectives as described below:

#### *GOALS -*

1. Provide education materials and programs regarding general groundwater protection.
2. Promote the use of groundwater protection tools to county and other local units of government that implement groundwater protection programs throughout the region.
3. Assist the state jurisdictions in accomplishing specific regional groundwater protection programs.
4. Provide a forum for the development of recommendations that address committee recognized regional protection needs.

*OBJECTIVES -*

1. Maintain an on-going general education subcommittee to work with citizen groups, schools, governing agencies and other interested parties on the importance of groundwater protection.
2. Promote the use of voluntary best management and P2 programs for businesses and residences located within groundwater recharge areas.
3. Work with county, municipal, and other special units of government to implement groundwater protection tools such as local zoning, maximum setback zones, technology control regulations, and defining recharge areas.

*STRATEGIES -*

1. Act as a catalyst for implementation of groundwater protection tools including presentations or meeting with local officials and businesses.
2. Conduct Groundwater Protection and Education Workshops for the general public or target audiences.
3. Focus on educating middle school teachers on the importance of incorporating groundwater science into their curricula.
4. Perform an annual self-evaluation review of program effectiveness.

During the past two years, the Illinois EPA and members of the Priority Groundwater Protection Planning Committees have met with local stakeholders to encourage the development of groundwater protection programs and to implement activities to protect CWS recharge areas. The following information provides a summary of community programs that the regional committees have targeted for groundwater protection efforts.

**Northern Groundwater Protection Planning Region (Winnebago, Boone, and Mc Henry counties)** - The Northern Groundwater Protection Planning Committee has assessed their efforts, and the following provides a summary of these actions:

*Loves Park PWD-* For the third consecutive summer, the city of Loves Park and the Northern Committee collaborated on a well-sealing program for residents in the five-year capture zone for Loves Park PWD Well #1. An intern went door-to-door helping residents determine whether they had an abandoned well on their premises. Over 330 homes were visited, with 91 abandoned driven point wells identified. A private well contractor and the Winnebago County Health Department sealed these 91 driven point wells using materials available from the reduced-cost bentonite program developed through the Northern Committee. Over 180 abandoned wells have been properly sealed since the program began in 2002. Additional wells were closed in Winnebago, Boone and McHenry counties for 11 private individuals through the same reduced-cost bentonite program. The Loves Park Drinking Water Protection Program aids in educating residents about groundwater. Word of mouth and positive media attention have helped the well sealing program gain respect and recognition throughout the community.

*North Caledonia* – The Northern Committee has provided groundwater protection/management information to a group of concerned citizens representing the village of North Caledonia. This citizen group has concerns regarding the rapid rate of development and the potential impacts this may have on groundwater resources, wastewater/septic system loading, and storm water management issues. Representatives of this citizen group have attended several of the Northern Committee meetings to express their concerns and lack of authority to address many of these potential environmental impact issues. To date, the Northern Committee has responded to several questions and provided technical assistance to this citizen group on general groundwater issues concerning new development, maintenance of private wells, and regulations related to becoming a public water supply. In addition, the Illinois Rural Water Association (IRWA) Source Water Protection Specialist has offered to assist the residents of North Caledonia in contacting representatives from United States Department of Agriculture Rural Development to pursue potential funding opportunities to investigate the possibility of developing a community water supply.

*Winnebago County Planning and Zoning Department* – Members of the Northern Committee and IRWA Source Water Protection Specialist have met with officials from the Winnebago County Planning and Zoning Department to encourage them to incorporate public water supply well location information as a layer in their new GIS mapping program at the county level. Additional well-specific information (i.e., minimum/maximum setback zones, CWS five-year capture zone delineations) can also be provided to the county zoning department to increase their awareness of this vital resource. This information can then be generated electronically, to assist in emergency response procedures and current/future land-use planning decisions that may impact groundwater quality or quantity. In addition, IRWA's Source Water Protection Specialist assisted each CWS in the county in developing Source Water Protection Contingency Plans For Emergency Preparedness and informed them of the overall Winnebago County Source Water Protection Program. As a result, each CWS received a copy of this document, which includes emergency contacts, phone numbers and resource materials available to each PWS in Winnebago county.

*McHenry County “Groundwater Resources Management Plan”* - The geology of McHenry County is made up of many sand and gravel, limestone, and sandstone formations. These aquifers serve as the source of all of McHenry County's drinking water. As the population grows, the demand for water is rising, the potential for contaminating aquifers increases, and wastewater disposal becomes more difficult. This combination of factors makes it essential for McHenry County to develop a Groundwater Resources Management Plan (Plan) that addresses the complete cycle of source, use, disposal and reuse. Effective, economical options are being devised that reflect the needs of the interested public, municipalities and officials of McHenry County. The scope of the plan was previously developed with the input of county and municipal officials, environmental groups, development-oriented organizations, interested businesses, citizens and members of the Northern Committee in active discussions of the issues so that a plan could be created that would receive wide support. The goal is to put together a plan that is a useful tool for balancing supplies and demands and reducing the potential of groundwater contamination. The plan consists of five sections, to be completed over a three-year span. The major sections of the plan are listed below:

Section 1: Groundwater Resources Management Framework; Section 2: Groundwater Resources Information for Planning; Section 3: Countywide Groundwater Protection Plan, Section 4: Countywide Wastewater Management Plan; and Section 5: Problem Assessments and Corrective Action Plans. More information on the status of each of these documents, including timeframes, public meeting notes, and draft reports can be found at: <http://www.mchenryh2o.org/>

**Northeastern Groundwater Protection Planning Region (Kane, Kendall, DuPage, Will, and Kankakee counties)** - The Northeastern Groundwater Protection Planning Committee has assessed their efforts, and the following provides a summary of these actions:

*Plano* - The city of Plano continues to work with the Northeastern Committee and the Illinois EPA to enhance their local WHPP. These initiatives have included: a graduate level P2 intern who completed a project at the Plano Molding Company, a plastic-resin injection molding processor; implementing procedures to comply with 35 Ill. Adm. Code 615 Subpart L: De-Icing Storage and Handling Units. These regulations are intended to minimize the risk posed by existing de-icing (road salt) storage areas located within well setback zones; and to raise public awareness, road signs have been posted along state highways intersecting the city's recharge areas. Most recently, the city has submitted a "Maximum Setback Zone" application and ordinance, for Illinois EPA review, to establish 1,000 feet setback zones for their CWS wells. In addition, members of the Northeastern Committee have approached the city about participation in the Groundwater Foundation's nationally recognized Groundwater Guardian Program.

*Kane County Water Resources Study* - The Kane County Water Resources Department was created in February 2000, probably the first of its kind in the state. The Water Resources Department was assigned the role of county water planner and charged with providing technical assistance on stormwater management planning. In the summer of 2001, the county solicited proposals for a comprehensive study of the geology, hydrology and water management needs for the county. The five-year study, now underway, will provide: improved resource maps; a thorough review of both groundwater and surface water resources, and actions by municipalities and the county to better manage the limited water supply. The ISGS and ISWS are conducting most of the research work, leading to a model of water sources and usages. Groundwater recharge areas will also be delineated. The county and local governments will then review options and strategies for balanced water management. Some options will probably relate to land management such as farmland protection or the purchase of development rights to protect recharge areas. At the Spring 2002 Making It Work Conference, "Don't Let the Tap Run Dry," a number of speakers spoke to about 150 municipal officials on water resource concerns addressed by the study and management options. The study will integrate shallow bedrock studies done in the late 1980s for the proposed Fermi Lab expansion with new work which will help define the deep bedrock aquifers, their recharge areas, and their sustainable yields. Members of the Northeastern Committee and Kane County communities are actively participating in the study.

**Central Groundwater Protection Planning Region (Peoria, Tazewell, Woodford and Mason counties)** - The Central Groundwater Protection Planning Committee has assessed their efforts, and the following provides a summary of these actions:

*Central Region Groundwater Protection Program Video* - In an effort to promote groundwater protection, education, and the functions of the Central Committee, a short video was developed, under contract with CDG Video's Inc. The purpose of this 10-minute video was to promote the activities and functions of the Central Committee, while also providing a basic understanding of groundwater science and the importance of this resource to the area. Furthermore, a concept was developed to use this "general" video as part one of a two-part series. The second portion of the video would highlight groundwater protection activities within a specific community, that could be used for classroom presentations, city council meetings, or to promote economic development. To date, this effort has led to community-specific videos being completed for Pleasant Valley PWD, Illinois American Water Company-Pekin, and the city of Peoria Heights.

*Pleasant Valley Public Water District* – Effective September 1, 2001, Pleasant Valley Public Water District (PWD), in Peoria County, became the state's first regulated recharge area, a defined area with specific regulations in place to protect vital groundwater resources. As such, the Illinois EPA was required to develop and implement a Chemical Substances Management Training Program for existing potential sources of groundwater contamination. With assistance from the Central Committee and a Pollution Prevention P2 Intern, the Illinois EPA offered this training on December 20, 2001, and March 25, 2002. As part of this training program, business owners were provided with technical assistance opportunities available thru pollution prevention alternatives, cost effective containment systems, an overview of the geologic sensitivity of the recharge areas for Pleasant Valley, and the importance of sealing abandoned wells in the area. A total of 15 small business owners became "certified" as meeting the requirements of this regulation.

*Mahomet Aquifer Consortium* - The Mahomet Aquifer Consortium (MAC) was formed in November 1998 to look toward developing an approach to better study and understand the Mahomet aquifer. The aquifer is a valuable resource and those with an interest in the aquifer, either because they use groundwater from the aquifer or because they are interested in utilizing the aquifer in the future, came together to discuss ways to study it in a comprehensive manner. The MAC has members from water authorities, water companies, local, county, state, and federal government, professional groups, and the Central Committee. The goal of the MAC is to study the aquifer so that, in the future, informed decisions can be made about meeting future water demand as populations increase and extreme weather events occur. A better understanding of the Mahomet aquifer will provide a mechanism to identify and resolve water quality issues that may threaten the aquifer. It will also provide the knowledge necessary to allow for the proper management of the aquifer using science, not litigation. The MAC has a very simple structure in that all members are voting members and everyone has an equal voice. In order to facilitate the setup and startup of the group, and to provide initial direction, a steering committee was agreed upon to provide the necessary leadership to work with outside groups and funding sources. For more information on the MAC, see their web site at: [www.MahometAquiferConsortium.org](http://www.MahometAquiferConsortium.org)

**Southern Groundwater Protection Planning Committee (Madison, Monroe, St. Clair, and Randolph counties)** The Southern Groundwater Protection Planning Committee has assessed their efforts, and the following provides a summary of these actions:

*East Alton* – The Southern Committee continues to assist the village of East Alton in groundwater protection as it relates to the contamination of one of East Alton’s CWS wells. With assistance from the Illinois EPA, IRWA and the Southern Committee, the village has implemented groundwater protection measures including evaluating the need to establish a maximum setback zone ordinance for their CWS wells, developing contingency planning procedures to protect their water supply from future problems and a stenciling project for storm water drains. In addition, the committee continues to be a current affiliate member of the Groundwater Guardian Program and actively recruit communities to participate in the program. East Alton was the second community in the four-county region to become a Groundwater Guardian Community and the recipient of a “Groundwater Shining Star” award.

*Well Sealing Campaign* – The Southern Committee purchased bentonite to assist in the sealing of private water wells in conjunction with the Water Well Abandonment Program launched by IDA and SWCD. The materials are provided at no cost to program participants in the four-county region, for the first year of the program or for as long as supplies last. There is an emphasis placed on the abandoned wells within the immediate proximity of a community water supply well. The use of the bentonite is also available for sinkhole stabilization projects, which in turn adds to the water quality within a karst area. The program remains intact at the present time with a representative of the committee currently working with the Illinois Water Well Sealing Coalition on proposed legislation for sealing abandoned wells.

*Fogelpole Cave* – The Southern Committee is looking to utilize the recharge delineation of the Fogelpole Cave Nature Preserve as a vehicle for awareness of groundwater issues in a karst area. The recharge area was based partly on dye-tracing projects funded by the Southern Committee in 1999. Fogelpole Cave Nature Preserve is a 27-acre tract located in Section 7, Township 4 South, Range 9 West of the Third Principal Meridian in Monroe County, Illinois. The recharge area of the Fogelpole Cave Nature Preserve includes 5.13 square miles of karst landscape (For more information on the Class III Groundwater designation of Fogelpole Cave refer to Chapter V, Sections 1 – 2).

## **Section 2. Continue to implement and integrate the WHPP elements into protecting the regional groundwater sources for public water supply wells**

The Illinois EPA is the primary agency responsible for developing and implementing this program. To date, the Illinois EPA has had some success related to the establishment of this activity. However, there is still much to be done.

The regional groundwater protection process has resulted in successful local coordination and outreach efforts that have benefited both private citizens and businesses in these high priority areas of the state (e.g., P2 interns, Groundwater Protection Field Days, well sealing demonstrations, etc.). Cooperative efforts with entities such as the Groundwater Guardian program will assist the regional groundwater protection process by providing national attention and recognition to CWS developing groundwater protection programs. Illinois EPA continues to promote the Groundwater Foundation's "Groundwater Guardian Affiliate" program. The Illinois EPA worked with each of the four Priority Groundwater Protection Planning Regions to become Groundwater Guardian Affiliates and to commit to a series of "result oriented services." These result-oriented services include working with communities within their respective regions to implement local source water protection programs and become Groundwater Guardian Communities.

Other activities conducted by the Regional Groundwater Protection Planning Committees to support both new and follow-up efforts of encouraging local and regional groundwater protection programs are summarized below:

#### **Northern Groundwater Protection Planning Committee**

The Northern Committee accomplished a number of tasks over the past two years. The Committee has identified two main goals: groundwater education and local government technical assistance, which includes sealing of improperly abandoned wells in all three counties.

*Inter-county Groundwater Protection Workshop for Teachers* – Members of the Northern Committee developed and participated in an Inter-county Groundwater Protection Workshop for Teachers from McHenry, Boone, Winnebago and Ogle counties on June 18, 2002. Nineteen teachers participated in the workshop, which was part of a 3-credit master's-level course, Environmental Science for Teachers, offered through Aurora University and Kishwaukee Intermediate Delivery Systems. The workshop involved the collaboration of 12 Committee members, staff from ISGS and DNR, Southern Illinois University and three teachers who taught various aspects of groundwater protection. The all-day workshop culminated with the teachers constructing groundwater flow models from groundwater kits donated by 22 community businesses, agencies and individuals. As part of the workshop, participating teachers were given a groundwater model for use in their respective school.

*Youth Groundwater Festival* - The ninth annual Youth Groundwater Festival was held March 12-13, 2003, at Rock Valley College. Nearly 900 fourth and fifth grade students attended the free-of-charge festival from Winnebago and Boone counties. Donations from area municipal water departments, Winnebago County Health Department, Burpee Museum, Rock Valley College, League of Women Voters, Retired Senior & Volunteer Services, and the Northern Committee provided funding for the event. Approximately 90 people volunteered to help put on the Festival, including members of the Committee, area educators, two high school science departments and environmental agencies and groups.

*HomeACRE Workshop* - In June 2002 the Northern Committee presented a HomeACRE workshop at Bel-Air Estates in Poplar Grove, IL, in Boone County. The program included well and septic maintenance, geology of the area, drainage issues and hazards and overuse of yard and garden chemicals. Seventeen members of the community attended the program and were provided informational brochures and contacts for local agencies involved in groundwater related activities. During May 2003, Committee members were also involved in a Wetlands Presentation to residents of the Glenn Abby South residential subdivision sponsored by the local Extension Service, Boone County SWCD and Boone County Conservation District. The presentation included information on fen areas and easements around residential areas and how to properly maintain them. A total of 15 people living in newly constructed homes came to learn about the wetland features located in their back yards.

### **Northeastern Groundwater Protection Planning Committee**

The Northeastern Committee has accomplished a number of tasks over the past two years. The main focus of the committee has been to promote a groundwater education curriculum for school districts within the region and developing a water well sealing program.

*DuPage County Groundwater Education Program* - Members of the Northeastern Committee assisted in the development of a Groundwater Education Program for teachers in DuPage County. A total of three separate “training” sessions were held earlier this year to help DuPage County teachers educate their sixth thru eighth grade students on general concepts related to groundwater and groundwater quality protection. The first phase of this program was completed with the training of 12 mentor/teachers and 25 middle school science teachers. Each mentor and teacher built a groundwater flow model representing DuPage County hydrogeologic conditions and received a number of educational materials. Mentor teachers completing all three sessions were eligible for 11 Continuing Professional Development Units. These sessions included; 1) general orientation to groundwater issues; 2) run-through of H2O Below Curriculum, building of ground water models; and 3) mentor teachers to assist in training other middle school and Jr. High teachers at a Science Conference during Teachers Institute Day. Evaluations by teachers, mentors, and several sponsoring agency representatives were outstanding. The DuPage Groundwater Mentor Team will present at the Illinois Science Teachers' Association this fall. In the next school year, if funding can be secured, the program will be expanded to cover more of the 125 schools serving about 67,000 middle school students in this rapidly growing Chicago suburban area with a population of over a million.

*Abandoned Well Sealing Program* - With successes learned from the Northern Committee, the Northeastern Committee developed a low-cost Abandoned Well Sealing Program to help promote and accelerate proper well sealing within the region. To assist in promoting this effort, a brochure and water well sealing guidelines have been developed and are available through the county health departments and soil and water conservation districts within the region. Each county health department has access to one or more pallets of bentonite for interested parties (private well owners) for pick up after all pre-sealing requirements have been met. Funding received from the sale of bentonite chips will be used to order more inventory, such that this will become an on-going effort.

*DuPage County Drinking Water Protection Program Workshop* – The Northeastern Committee sponsored a training workshop entitled, "Drinking Water Protection Program for DuPage County" held at the Danada Forest Preserve on June 27, 2003, in Wheaton, IL. A workshop in DuPage County was chosen because this county was recently added to the Northeastern Priority Groundwater Protection Planning Region. Approximately 60 individuals attended this training workshop including: community water supply officials; environmental health professionals, consultants; local well drillers and members of the general public. Participants of this one day training session learned more about the DuPage County "Supplemental Well Ordinance" requirements, how various municipalities within DuPage County have begun to incorporate the DuPage County Health Department rules into their procedures, the importance of local municipalities developing and implementing a comprehensive Cross-Connection Control Program and information related to proper maintenance of private water supply wells. In addition, a local well driller demonstrated how to properly seal an abandoned well. Organizers of this workshop were able to develop an agenda that offered 3.5 hours of Renewal Training Credit for drinking water supply operators and 4.5 hours of Continuing Education Credits for Licensed Environmental Health Practitioners. This was the first time that a regional groundwater committee function has offered *approved* training credits.

### **Central Groundwater Protection Planning Committee**

The Central Committee has accomplished a number of activities over the past two years. These activities can be broadly categorized as: public education efforts, and promotion of local government/business technical assistance programs.

*2003 Clean Water Celebration* – The Clean Water Celebration began as a cooperative effort in 1992 between the Sun Foundation and the Rivers Project. The largest event of its kind in the world, the Clean Water Celebration is a two-day workshop for students, teachers and the public, held each spring at the Peoria Civic Center in Peoria, IL. The Clean Water Celebration incorporates a variety of programs for students combining the arts and sciences, and has grown each year to become a truly unique educational experience. Over 3,000 Illinois students participated in the 10<sup>th</sup> Annual Celebration, held on March 23-24, 2003. Thirty schools and over 40 environmental organizations and businesses exhibited on a wide range of topics from zebra mussels and wildlife of the wetlands to recycling and water treatment. Back by popular demand in the exhibit area was "environmental streams" in which students flowed through various presentations on fish and aquatic life, watershed protection, birds and drinking water. The "Parade of Waters" was the kickoff for the Clean Water Celebration. High school students brought water from different Illinois rivers, lakes and streams. This was to symbolize all of the waters of the state of Illinois together. Three "Making Waves" awards were presented to groups or individuals that made a difference to the cleanliness of water and the environment. Members of the Central Committee continue to support the Clean Water Celebration by volunteering to serve on the navigating committee, helping to staff learning sessions, and providing financial support to help defray transportation expenses for school districts within the region.

*Edith Stevens Groundwater Educator Award* - This Groundwater Foundation National Award recognizes individuals who understand the importance of groundwater, motivate others to protect groundwater, and lead by personal example. Patricia Welch, Emergency Response Coordinator for the Illinois Department of Public Health, has been selected to receive the *Edith Stevens Groundwater Educator Award* for 2003. Ms. Welch was presented this award on November 13, 2003, at the Groundwater Foundation's Annual Conference in Las Vegas, Nevada. In 1991, following the enactment of the Illinois Groundwater Protection Act, Ms. Welch volunteered to serve on the Central Regional Groundwater Protection Committee. The Central Committee was the state's first to develop a groundwater education plan, and held one of the first well-sealing demonstrations. Ms. Welch also led the first groundwater education workshop for teachers. At the workshop, teachers built groundwater models using local well logs. This workshop led to the development of the Illinois Middle School Groundwater Project, which has placed over 800 groundwater models using local geology in area schools. Ms. Welch was instrumental in developing the Clean Water Celebration, an environmental classroom program, and has served as a member of the Planning Committee for the past 10 years. Begun in 1993, the Clean Water Celebration is a two-day annual event educating middle and high school students, their teachers, and the general public about water quality protection and conservation. In addition, Ms. Welch worked with an FFA Chapter to encourage water sampling and testing, organized and mentored college interns to provide direct Pollution Prevention assistance to local businesses in groundwater protection areas, and organized the Tazewell County Environmental Education Day for all county fifth graders.

*Tri-County Green Matters Program* – A consortium of local and state government agencies, including the Tazewell and Woodford County Health Departments, Peoria County Solid Waste Management Department, Illinois Waste Management and Research Center, and the Central Committee, are sponsoring the Tri-County Green Matters Program. The Green Matters Program is a voluntary effort that provides recognition to area businesses, institutions, local governments and others that are leaders in environmental stewardship. The goal of this program is to encourage greater environmental performance in such areas as waste reduction, energy efficiency and resource management and use. The program has three levels of recognition; the more proactive facilities are, the more recognition they receive. Businesses participating in the Green Matters Program can benefit in a number of ways, including: profit from reduced waste disposal costs, increased efficiency and enhanced image with the public and their employees; receive local recognition for their environmental efforts; and get free technical assistance on a variety of environmental topics. For more information regarding this program, see: [www.tchd.net/greenmatters/tricountygreenmatters](http://www.tchd.net/greenmatters/tricountygreenmatters)

*Norwood Middle School Groundwater Education Field Day* – In an attempt to further promote the regulated recharge area designation for Pleasant Valley PWD and heighten local awareness, Illinois EPA, DNR, IDPH, and the Peoria County Health Department sponsored a groundwater education field day at the Norwood Middle School on September 26, 2002. Five classes of seventh and eighth grade students, with their teachers, circulated through various learning stations at 20-30 minute intervals. Each learning station had a specific theme, including: recycling, importance of sealing abandoned wells, groundwater science and run-pump-and-carry relay contest, land and water/non-point pollution, and water treatment, distribution, and protection efforts related to the Pleasant Valley Water System.

### **Southern Groundwater Protection Planning Committee**

The Southern Committee has accomplished a number of tasks over the past two years. These activities can be broadly categorized as public education efforts in karst terrains, and promotion within the region of a water well sealing program.

*Water Stewardship Project* – The Southern Groundwater Committee co-sponsored a Water Stewardship Project for area fifth graders at Lewis & Clark Community College in Godfrey, IL on May 2, 2003. This was preceded by an April 28 Teacher Training Workshop that helped prepare the teachers to facilitate the information of the project. The objectives of this Stewardship Festival were to: promote general knowledge about water ecology and environmental education; inform students and educators about resources available in the state and region which support clean water; educate students about the science of water quality and water ecology; and promote knowledge about the relationship of water quality and health among humans.

*Groundwater Field Day* – On May 10, 2002, a total of 53 participants attended a Groundwater Protection Field Day held in Monroe County. The field day focused on groundwater protection with specific emphasis placed on awareness throughout the high priority area of karst. This event provided an overview of the current local initiatives to protect groundwater in the American Bottoms aquifer. Local high school students provided displays on field-testing techniques for surface water supplies and a demonstration was held on various sewage removal practices occurring within the American Bottoms aquifer.

*Groundwater Lending Library* – The committee has an on-going goal of encouraging local stakeholders to become more aware and active in groundwater protection strategies throughout the southern region. To this end, an informational campaign continues to collect and develop materials regarding groundwater protection to be utilized by various governmental and local agencies. As part of the lending library, the committee has incorporated a display board that can be used by members and loaned to various local agencies to support groundwater protection/educational outreach efforts at area conferences, community functions and county fairs.

*Karst Short Course* – Selected committee members participated in a C2000 Karst Short Course held by Missouri-based Ozark Underground Laboratory. The topics covered included an introduction of karst, karst hydrology, and sewage disposal in karstified topography. Also more technical issues, such as recharge area delineations utilizing dye-tracing and resource management within karst areas were discussed. This course was intended to disseminate current research in this area and suggest to the participants how to utilize this information. Since many water quality decisions in this four-county area are affected by karst, the committee felt it an asset to have members attend.

## **CHAPTER VIII. NON-COMMUNITY AND PRIVATE WELL PROGRAM**

### **Section 1. Continue to implement the WHPP, and assist with implementing the technology control and groundwater quality standards regulations**

The IDPH has primary responsibility for inspections of approximately 3,837 non-community public water supplies (NCPWSs), which are performed at least once every two years. At the time of these inspections, the area surrounding the wellhead is inspected for potential sources of contamination. Permits for new construction, modification or an extension of an existing non-community water system will continue to be required.

### **Section 2. Complete the source water assessments of all NCPWSs**

Required by amendments to the Safe Drinking Water Act, IDPH is completing source water assessments of all NCPWSs. Approximately 6,000 water wells and 27 surface water supplies serve as the sources of water to these systems. These wells and surface supplies are being identified and evaluated as to their vulnerability to potential contamination from sources such as sewage systems, abandoned wells, buried fuel tanks and chemical storage areas. The vulnerability assessments conducted in the past were confined to an area within a 200-foot radius around the well. This new initiative expands that radius to 1,000 feet.

As part of the field survey for each supply, wells and potential contamination sources within 1,000 feet are identified and located on an aerial photograph. Aerial photographs are then submitted to the Illinois EPA where they are scanned and rectified. Wells and potential contamination sources are then digitized using the rectified aerial photographs. Each site is described on a standardized coding form, and is then entered into Illinois EPA's Waterworks Database (H2O Works).

This project brings together resources from the Illinois Department of Transportation (IDOT), Illinois EPA, local health departments, and IDPH. The IDOT is providing aerial photographic maps of the area surrounding each supply and Illinois EPA is entering the data into a GIS format. This project began in 1998 and took three years to complete for supplies that were listed as active at that time. Local health departments are being compensated from federal funding through U.S. EPA for conducting the assessments. The IDPH regional staffs are conducting assessments at supplies with facilities that are either licensed by the state health department or located in counties where there are no local health departments. IDPH is using the data collected from the source water assessments to write a susceptibility assessment for each supply. As part of the assessment process, IDPH takes into consideration land use, previous sampling data and geological data when completing the reports. The susceptibility report will determine, from the information, if the supply is susceptible to contamination. As these assessments are completed, copies of the reports will be sent to Illinois EPA and the water supply.

### **Section 3. Complete GIS coverage for NCPWSs**

Essentially, the GIS coverage for NCPWSs was completed in October 2003 as part of the source water assessment program. The final coverage contains approximately 4,026 NCPWS wells. However, 23 additional wells are currently being reviewed and will be added to the coverage in the near future. This was accomplished by taking aerial photographs, which have been drafted with well location from field surveys, and registering them against the county road coverage. Once registered, in real world coordinates, the photos are displayed and the well location is digitized into a statewide coverage from its drafted location on the photograph.

### **Section 4. Continue certification training of non-transient, NCPWS operators**

In accordance with amendments to the federal SDWA and recent U.S. EPA drinking water regulations, all non-transient, NCPWSs must be operated by personnel who have completed training approved by the IDPH. Certified operators will be required to be re-certified every three years by attending a training session approved by the IDPH that addresses new technology and new drinking water regulations. Program staff has met with the Water Quality Association to develop the curriculum. This Association provides training to operators of small water systems and has developed materials and courses similar to the training that is required for non-transient, non-community operators.

There are approximately 428 non-transient, NCPWSs that will need certified operators. IDPH has grandfathered the existing operators. As of August 4, 2003, the Water Quality Association has offered 22 classes. Through these classes, 498 individuals have become IDPH certified operators. There are currently 31 operators who are certified through the Illinois EPA. IDPH has received a grant to reimburse operators for taking the class and for travel. The grant will also be used to reimburse certified operators for their first renewal class.

### **Section 5. Continue to inspect and perform laboratory analyses on water samples collected from NCPWSs**

Under the authority of the IGPA, Section 9, the IDPH has primary responsibility for the inspection of all NCPWS, performed at least once every two years. At the time of these inspections, the area surrounding the wellhead is inspected for sources of contamination.

Water samples are collected from all NCPWSs and tested by certified laboratories for the presence of coliform bacteria and nitrate concentration. All NCPWS are sampled quarterly the first year for coliform bacteria. Thereafter, the frequency of coliform bacteria testing is based on the population a particular supply serves. NCPWS serving populations less than 1,000 must be tested at least once per year. For populations greater than 1,000, the sample frequency is the same as CWSs. As a minimum, all NCPWS are tested for nitrate concentration once every year.

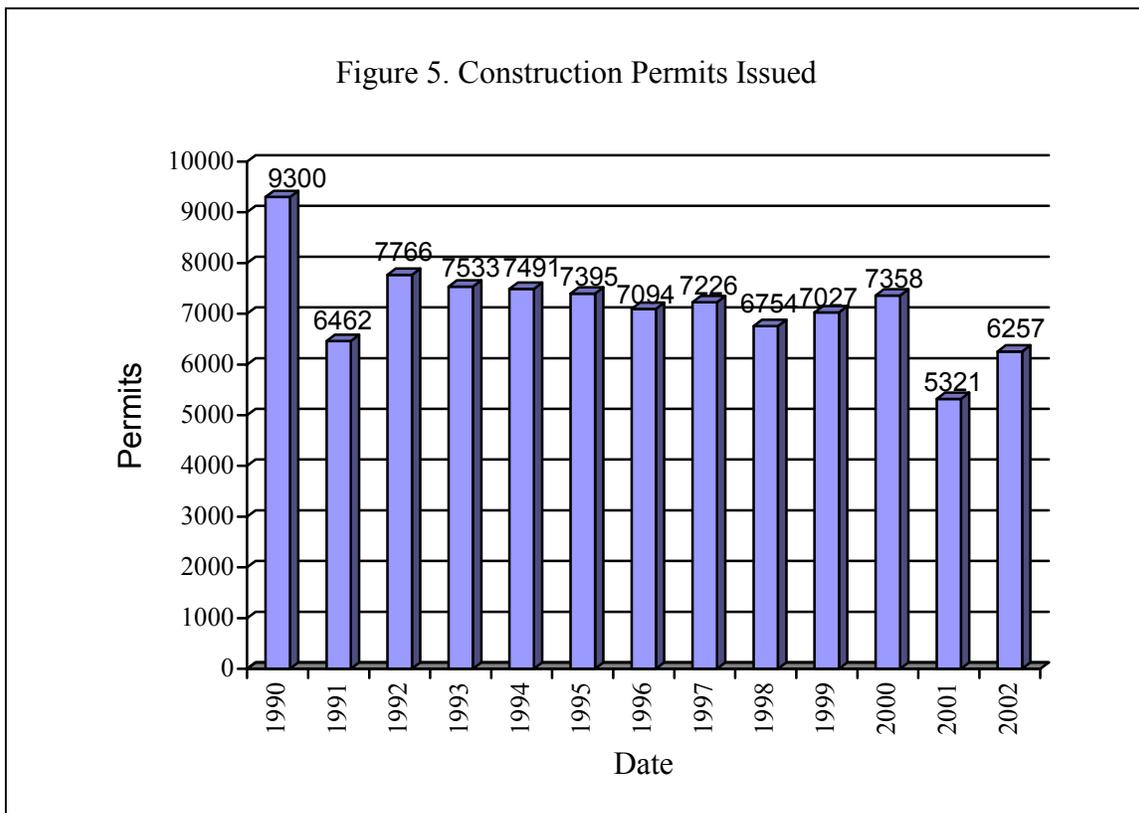
*Non-transient non-community water systems* - Of the 3,387 NCPWS, 428 are non-transient, NCPWS. A non-transient, non-community water supplies (NCWS) is one that serves the same 25 or more individuals at least six months a year, such as schools and workplaces. About half serve schools. The NCPWS must meet all requirements under the SDWA.

**Section 6. Continue to issue permits for the construction, modification or extension of existing NCPWSs**

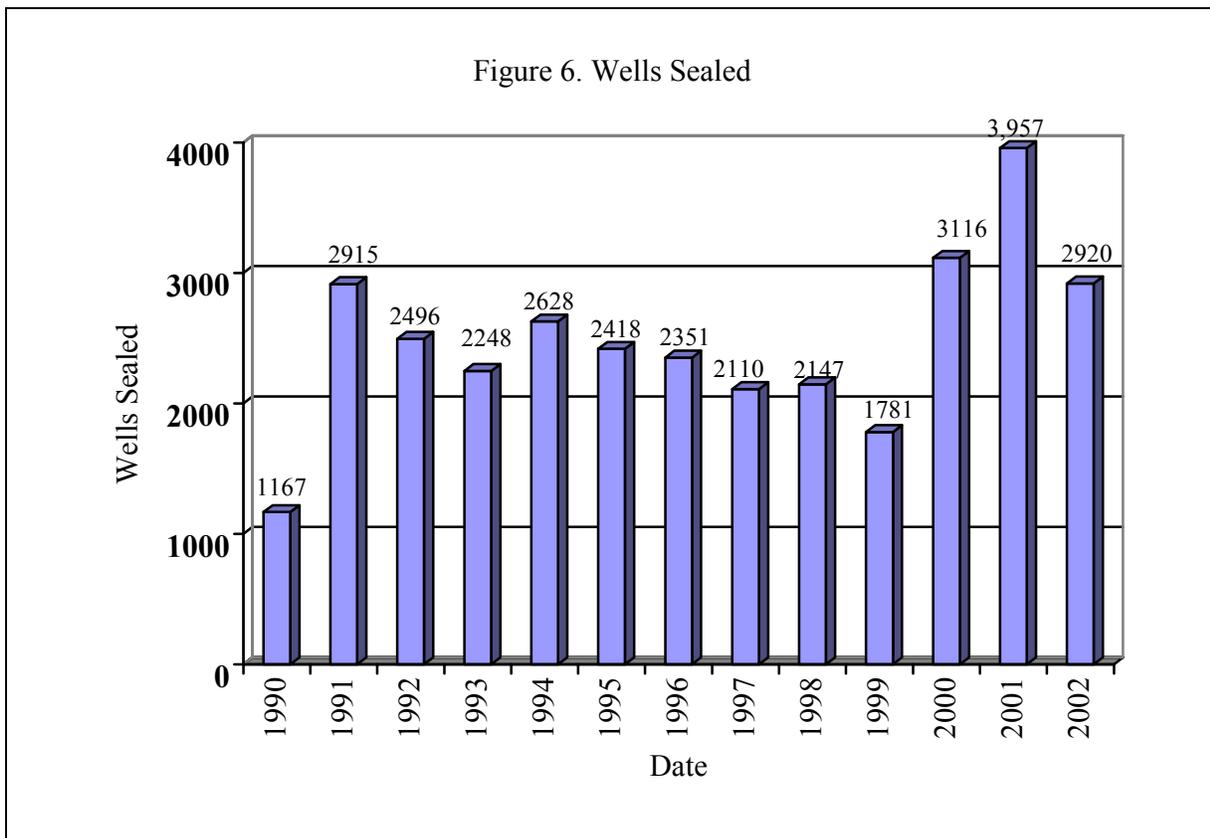
Approximately 92 permits are issued each year for the construction, modification or an extension of an existing NCPWS. NCPWSs in Illinois serve a population of approximately 552,500 citizens. These are water systems that serve 25 or more people for at least 60 days per year. Examples are water systems that serve schools, restaurants, factories, power generating stations, office buildings, campgrounds, state parks and highway rest stops.

**Section 7. Continue the issuance of permits for all types of water wells with the exception of CWS wells**

During the last two years, approximately 5,800 permits to construct private, semi-private, non-community and non-potable water wells were issued annually by IDPH and 87 local health departments. Figure 5 illustrates the number of water wells permitted during 1990-2002. All new wells are inspected to ensure that location and construction specifications have been met in accordance with the requirements of the Illinois Water Well Construction and Pump Installation Codes. In accordance with the IGPA, all new wells must be located at least 200 feet away from all potential primary and secondary sources of contamination and all potential routes. Additionally, water samples from new wells are tested by certified laboratories for the presence of coliform bacteria and nitrate concentration.



Of major significance was the increase in the number of abandoned wells that were sealed. During the year 2001, approximately 3,957 abandoned wells were sealed. This is an increase of 841 or 27 percent over the number of wells sealed in 2000, when 3,116 wells were sealed. This is the highest number and the second largest increase in the number of wells sealed since the IGPA became effective on September 24, 1987. Local health departments and IDPH inspect the sealing of abandoned wells to ensure they are properly sealed in accordance with the Illinois Water Well Construction Code. Figure 6 illustrates the number of water wells sealed during 1990-2002.



### **Section 8. Implement the amendments to the Illinois Water Well Construction Code initiated in 2000**

Amendments to the Illinois Water Well Construction Code became effective on August 1, 2000. The purpose of these amendments is to keep the Code up-to-date with current industry standards and to clarify existing requirements regarding water well construction. These amendments primarily impact the procedures for constructing drilled wells and the sealing of abandoned dug and bored wells.

The purpose of grouting is to prevent the migration of contaminants through the annular space (the space that is between the borehole and the well casing) and into the well and aquifer that the well penetrates. In the construction of drilled wells, the minimum borehole diameter was increased and the minimum grouting depth was established. Procedures for grouting the annular space were both clarified and expanded.

A subsection was added to clarify three procedures for sealing abandoned dug and bored wells. In this subsection, an additional procedure for sealing abandoned bored and dug wells was established. The new procedure specifies the placement of alternate layers of bentonite and agriculture limestone (limestone fines). In the past, there were no requirements for sealing bored wells constructed with buried slabs. Construction of these wells began approximately 40 years ago and as they become aged, an increasing number of these wells are being abandoned. Requirements for sealing these wells were established in a new subsection. The sealing procedure requires disinfected clean pea gravel or limestone chips to be placed to within one foot below the buried slab. The upper part of the well, to where the casing is removed, shall be sealed with neat cement or bentonite.

The requirements for monitoring and closed loop heat pump wells remain in effect. The Illinois Water Well Pump Installation Code requires a backflow device where a chemical injection system is connected directly to a water well used for irrigation and which is not used as a potable water supply.

### **Section 9. Continue supporting education-training sessions for licensed water well and pump installation contractors**

*Continuing education requirements for licensed water well and pump installation contractors -* The Water Well and Pump Installation Contractor's License Act requires all licensed water well drillers and pump installation contractors to attend a six-hour continuing education session every two years. In order to renew a license, a contractor must provide proof of attendance, such as a certificate from the training organization.

Plumbers who install or repair water well pumps and pumping equipment must be licensed as a pump installation contractor and attend a continuing education session every two years. However, plumbers are not required to take the water well pump installation contractor's license examination or to pay the license fee. They are only required to make an application for the license.

The training sessions, which must be approved by IDPH, are intended to increase a contractor's knowledge by providing new industry information and updates, as well as to allow health officials to bring current problems to the attention of the industry. Topics for the sessions included lithological identification of drill cuttings, disinfection and chemical rehabilitation of water wells, drilling methods, grouting, pump installation, transportation of hazardous materials, groundwater contamination, well construction and pump installation codes, safety and well abandonment. Approximately 350 water well contractors and 900 water well pump installation contractors, licensed by the Department, are required to attend these training sessions. Seventeen training sessions were held throughout the state during 2002-2003. All but three of these sessions were conducted through the Illinois Association of Groundwater Professionals.

Amendments to the Illinois Water Well and Pump Installation Contractor's License Code became effective on August 1, 2000. The purpose of these amendments is to keep the Code up-to-date with current industry standards and to clarify existing requirements, regarding continuing education for licensed water well and pump installation contractors. A new section was established to clarify the requirements for the renewal of expired licenses. Four sections were added to establish requirements for continuing education.

#### **Section 10. Continue to conduct training sessions pertaining to both the NCPWS and private-water program for local health department and IDPH water program staff**

*Training sessions for local health department and IDPH water program staff* - Water program staff from 87 local health departments and IDPH attended 37 water program-training sessions throughout the state. Fifteen of the sessions coincided with the above sessions for licensed water well and pump installation contractors. The Illinois Association of Groundwater Professionals provided seven sessions pertaining to the inspection procedures for the construction of water wells and the sealing of abandoned wells. As part of its annual and chapter education conferences, the Illinois Environmental Health Association sponsored 15 sessions with topics pertaining to water supply security, water well inspection, closed loop well construction, well construction code, groundwater contamination and water treatment. The sessions were approved by IDPH as meeting the annual water program-training requirement for local health department water program staff under the Local Health Protection Grant Rules (77 Ill. Adm. Code 615).

#### **Section 11. Finalize conversion of the IDPH database onto the State Safe Drinking Water Information System**

The IDPH has funding set aside to have the current database converted and migrated to the state Safe Drinking Water Information System (SDWIS). The IDPH had contracted, through U.S. EPA, to hire SAIC, the company that developed SDWIS, to do the conversion to SDWIS. However, SAIC's contract with U.S. EPA will come up for renewal before SAIC would be able to complete the conversion for IDPH. If SAIC's contract with U.S. EPA is renewed, the IDPH database conversion will begin as soon as possible. If SAIC's contract with U.S. EPA is not renewed, IDPH will have to put the conversion project out for bid.

## **CHAPTER IX. GROUNDWATER PROTECTION RECOMMENDATIONS AND FUTURE DIRECTIONS**

The following groundwater protection efforts recommended for the next two years are based on the results of the self-assessment and environmental indicators presented in this report. In some tasks, the priority may be shifted due to funding constraints. The overall groundwater quality protection indicator shows that the overall progress of implementing the IGPA continues to be adequate. However, proactive groundwater protection measures for new CWS wells need to be improved. In addition, efforts and resources should continue to focus on critical regional recharge areas supporting unconfined CWS wells.

### **ICCG Operations**

- Assist the GAC in the review and development of recommendations pertaining to groundwater quantity issues;
- Continue to enhance coordination between Illinois EPA BOW and Land Remediation Programs;
- Continue to review and update the Implementation Plan and Regulatory Agenda;
- Work with the GAC and Regional Groundwater Protection Committees to sponsor a Groundwater Protection Policy Forum;
- Continue to hold quarterly meetings;
- Provide liaison for the GAC;
- Enhance Web-based educational materials;
- Assist in implementation of the Illinois Generic Management Plan for Pesticides in Groundwater;
- Review and support the annual groundwater education work plan;
- Evaluate the development of Class III Special Resource Groundwater for Dedicated Nature Preserves; and
- Review regulated recharge area proposals.

### **GAC Operations**

- Review and make recommendations regarding groundwater issues;
- Conduct policy related meetings; and,
- Provide input to programs, plans, regulatory proposals and reports as appropriate.

### **Education Program for Groundwater Protection**

- Coordinate and conduct a statewide education program with an annual evaluation and work plan involving local, regional and state organizations and agencies. Support the integration of groundwater protection into state and local agency educational programs;
- Support regional groundwater protection committees with special education programs based on regional needs. Emphasize programs for wellhead protection involving local water, planning, and health authorities;
- Through educational institutions and organizations, curriculum projects, and teacher workshops, integrate groundwater principles and groundwater protection into the curriculum for grades 3-12, emphasizing correlation with Illinois Learning Standards;
- As groundwater recharge maps are published for community water supplies, provide educational programs to improve understanding and to develop community actions involving teachers and students;
- Organize and conduct educational programs for private well owners, involving licensed water well contractors, local health departments, SWCDs, University of Illinois–Extension offices, and other organizations. These programs will address well abandonment, water budgets, nitrate management, wellhead protection, disinfection, testing, operation and maintenance methods; and
- Secure funding to introduce the Healthy Water -Healthy People educational materials, continue the Illinois Middle School Groundwater Project and other educational projects identified in the annual work plan and provide teachers with groundwater educational tools.

### **Groundwater Evaluation Program**

- Continue to improve the SWAP GIS to include more interactive features;
- Continue to share GIS coverages in an electronic format and continue to automate the groundwater resource data base for Illinois;
- Continue to conduct groundwater assessments and share the information through regular updates and completed reports;
- Continue to utilize innovative and cost effective methods to implement statewide groundwater quality monitoring;
- Continue assessing and evaluating emerging contaminants of concern; and
- Continue to implement and improve overall groundwater quality indicators.

## **Groundwater Quality Standards and Technology Control Regulations**

- Evaluate the need to develop Class III: Special Resource Groundwater Standards;
- Evaluate Dedicated Nature Preserves for Class III designation;
- Develop proposed groundwater quality standards for emerging contaminants of concern;
- Continue to implement and integrate the groundwater quality standards into environmental programs;
- Continue to update and amend the groundwater standards to parallel the drinking water standards adopted by U.S. EPA;
- Continue to implement preventive notice and response programs and integrate with environmental programs;
- Continue to implement the technology control regulations and improve a database for tracking and evaluating compliance data;
- Evaluation of activities located proximate to CWS where local groundwater protection management efforts are completed or in progress will be given priority;
- Evaluation and compliance determinations for activities referred by permit programs will also be given priority; and
- Continue cooperation between the Illinois EPA and the IDPH to provide statewide education seminars on the implementation of the technology control and groundwater standards regulations.

## **Wellhead Protection Program**

- Develop new Illinois EPA source water protection criteria and rules;
- Begin integration of Illinois EPA's Groundwater and Field Operation Sections' programs for providing technical assistance in source water protection and engineering evaluations (sanitary surveys);
- Continue to publish wellhead protection and assessment data at <http://www.epa.state.il.us/water/groundwater/source-water-quality-program.html>;
- Increase the percentage of intensive groundwater protection management for Community Water Supply Wells;
- Develop and implement source protection criteria to use in the planning, construction and location of new community water supplies;
- Continue integration and implementation of the WHPP under the SDWA new alternative monitoring program;
- Finish the delineation of recharge areas for CWSs using reasonably available information;
- Modify CWS water well construction permit application procedures to include collection of information on potential sources and routes, well logs, pumping tests and chemical analyses;
- Illinois EPA will continue to work with the Natural Resources Conservation Service (NRCS), Soil and Water Conservation Districts (SWCD), and other local

stakeholders to establish conservation reserve programs for agricultural cropland located within the delineated recharge areas of CWS wells;

- The Illinois EPA, IDA, Illinois Association of SWCDs, University of Illinois Extension and the county Soil and Water Association Districts should continue to work together to implement *Illinois FarmAsyst* and related programs in source water protection areas;
- Efforts to expand the Illinois Water Well Decommissioning Program should also be evaluated; and
- Promote the new Source Protection Plan Guidance.

### **Regional Groundwater Protection Planning Program**

- Current committee flexibility should be maintained while assisting with conducting and supporting both new and follow-up efforts of encouraging local and regional groundwater protection programs and
- Continue to implement and integrate the WHPP elements into protecting the regional groundwater sources for public water supply wells.

### **Non-Community and Private Well Program**

- Continue to implement the WHPP, and assist with implementing the technology control and groundwater quality standards regulations;
- Continue the source water assessments of all NCPWSs;
- Continue certification training of non-transient, NCPWS operators;
- Continue to inspect and perform laboratory analyses on water samples collected from NCPWSs;
- Continue to issue permits for the construction, modification or extension of existing NCPWSs;
- Continue the issuance of permits for all types of water wells with the exception of CWS wells;
- Continue supporting education training sessions for licensed water well and pump installation contractors;
- Continue to conduct training sessions pertaining to both the NCPWS and private-water program for local health departments and IDPH water program staff; and
- Continue conversion of the IDPH database onto the SDWIS State.

Appendix I:

**Groundwater and Related Publications by the Illinois State Geological Survey and the Illinois State Water Survey for 2002 & 2003**

For a complete list of ISGS Publications, see <http://crystal.isgs.uiuc.edu/isgshome/pubs-prod.htm>  
To search the ISWS publications, see <http://www.sws.uiuc.edu/pubs/isearch.asp>

Bade, J., J.J. Lewis, S.J. Taylor, D. Tecic, D.W. Webb, D. Brand, S.V. Panno, K. Hartman, Jr., and P. Moss, 2002. Illinois Cave amphipod (*Gammarus acherondytes*) recovery plan, U.S. Fish and Wildlife Service, Great Lakes-Big River Region (Region 3), Ft. Snelling, MN, 63 p.

Burch, S.L. 2002. A Comparison of Potentiometric Surfaces for the Cambrian-Ordovician Aquifers of Northeastern Illinois, 1995 and 2000. *Illinois State Water Survey Data/Case Study 2002-02*.

Herzog, B.L., D.R. Larson, C.C. Abert, S.D. Wilson, and G.S. Roadcap. 2003. Hydrostratigraphic Modeling of a Complex, Glacial-Drift Aquifer System for Importation into MODFLOW. *Ground Water* **41** (1): 57-65.

Hwang, H.-H., M. Wander, W. Beaumont, T.M. Johnson, and E. Mehnert, 2002. Denitrification as revealed by isotope ratios in tile-drained agricultural watershed in central Illinois, in Abstracts with Program of the Southeastern and North-Central Sections Annual Meeting, Geologic Society of America, Lexington, KY, April 3-5, 2002, Vol. 34, No. 2, p. A-113. (abstract)

Illinois State Geological Survey, 2001. Response of the Illinois State Geological Survey (ISGS) to Illinois Senate Resolution 0137 & House Resolution 0365. 12 p.

Illinois State Water Survey, 2001. A Plan for Scientific Assessment of Water Supplies in Illinois. ISWS Information/Educational Material 2001-03. 22 p.

Ipe, V.C., and S.B. Bhagwat, 2003. Water Resources in Illinois: Demand, Prices, and Scarcity Rents, Illinois State Geological Survey Industrial Minerals 126, 11 p.

Keefer, D.A., 2002. Addressing uncertainty in geologic data and maps, in Abstracts with Program of the Southeastern and North-Central Sections Annual Meeting, Geologic Society of America, Lexington, KY, April 3-5, 2002, Vol. 34, No. 2, p. A-18. (abstract)

Keefer, D.A., 2002. Consequences of uncertainty in geologic maps, in Abstracts with Program of the National Ground Water Association Midwest FOCUS Ground Water Conference, Chicago, IL, April 11-12, 2002, p. 23. (abstract)

Keefer, D.A., E.D. McKay, and R.C. Berg, 2002. Evaluating uncertainty in geologic models from the IL29 Geologic Mapping Project. Geological Survey of Canada Open File 1449, p. 27-31. (abstract)

- Kelly, W.R., and S.D. Wilson. 2002. Temporal changes in shallow groundwater quality in northeastern Illinois. *In Research on Agricultural Chemicals in Illinois Groundwater: Status and Future Directions XII, Proceedings of the Twelfth Annual Illinois Groundwater Consortium Conference*, Makanda, IL, April 22, 2003. (<http://www.siu.edu/orca/igc/proceedings/02/kelly.pdf> accessed June 16, 2003).
- Killey, M.M., and D.R. Larson, 2003. Groundwater: A vital Illinois resource, Illinois State Geological Survey GeoScience Education Series 17, in press.
- Krapac, I.G., W.S. Dey, W.R. Roy, C.A. Smyth, E. Storment, S.L. Sargent and J.D. Steele, 2002. Impacts of swine manure pits on groundwater quality, *Environmental Pollution*, **120**(2): 475-492.
- Larson, D.R., E. Mehnert and B.L. Herzog, 2003. The Mahomet aquifer: A transboundary resource in east-central Illinois, *Water International*, **28** (2): 170-180.
- Larson, D.R., B.L. Herzog, and T.H. Larson, 2003. Groundwater Geology of DeWitt, Piatt, and Northern Macon counties, Illinois, Illinois State Geological Survey Environmental Geology 155.
- Larson, D.R., and R.J. Finley, 2002. Peaker power plants and water resources— an Illinois perspective, in Abstracts with Program of the Southeastern and North-Central Sections Annual Meeting, Geologic Society of America, Lexington, KY, April 3-5, 2002, **34** (2): A-29. (abstract)
- Larson, T.H., and A.J.M. Pugin, 2002. High-resolution geophysical imaging of glacial aquifers in Illinois, in Abstracts with Program of the National Ground Water Association Midwest FOCUS Ground Water Conference, Chicago, IL, April 11-12, 2002, p. 24. (abstract)
- Lim, J., B. Hacker, L. Sze, D. Splitt, S.R. Gustison, H.A. Wehrmann, H.V. Knapp, S. Sinclair, and R.J. Finley, 2002. Energy Facilities Screening in Illinois: Mine-Mouth Power Plants. 27 p.
- Lin, Y-F., D. Walker, and S. Meyer. 2003. Groundwater Flow Models of Northeastern Illinois: A Case Study for Building MODFLOW Models with GIS. *Proceedings of MODFLOW and More 2003, Understanding through Modeling, Volume II*: 863–867, September 2003, Golden, CO.
- Lin, Y-F., and M.P. Anderson. 2003. A Digital Procedure for Ground Water Recharge and Discharge Pattern Recognition and Rate Estimation. *Ground Water* **41** (3): 306-315.
- McKenna, S., D. Walker, and B. Arnold. 2003. Modeling sub gridblock scale dispersion in three-dimensional heterogeneous fractured media. *J. Contaminant Hydrology* **62-63**: 577-594.
- Mehnert, E., D.A. Keefer, W.S. Dey, H.A. Wehrmann, S.D. Wilson, and C. Ray, 2003. Illinois' aquifer sensitivity to contamination by pesticide leaching-- initial evaluation, The Geological Society of America, 37th Annual Meeting of the North-Central Section, Kansas City, MO, February 2003, 2003 Abstracts with Programs, **35** (2): 15. (Abstract)

Mehnert, E., and G. B. Dreher, 2002. The Geochemistry of Groundwater from the Shallow Bedrock in Central Vermilion County, Illinois, Illinois State Geological Survey Open-File Series Report 2002-4, 43 p.

Mehnert, E., H.A. Wehrmann, and K.L. Warner, 2002. The Mahomet Aquifer Consortium: an effective grassroots, water resources organization, Illinois Water 2002, Illinois Water Resources Center, Champaign, IL, November 6-7, 2002, p. 30. (abstract)

Mehnert, E., W.S. Dey, H.-H. Hwang, D.A. Keefer, T.R. Holm, J.R. Karny, R.A. Sanford, and T.M. Johnson, 2002. Mass balance of nitrogen in a tile-drained, agricultural watershed in central Illinois, in Abstracts with Program of the National Ground Water Association Midwest FOCUS Ground Water Conference, Chicago, IL, April 11-12, 2002, p. 10. (abstract)

Meyer, S.C. 2002a. Impacts of Urbanization on Base Flow and Recharge Rates, Northeastern Illinois: Summary of Year 2 Activities. In *Research on Agricultural Chemicals in Illinois Groundwater: Status and Future Directions XII, Proceedings of the Twelfth Annual Illinois Groundwater Consortium Conference*, Makanda, IL, April 22, 2003. (<http://www.siu.edu/orda/igc/proceedings/02/meyer.pdf> accessed June 16, 2003).

Meyer, S.C. 2002b. Impacts of urbanization on base flow and recharge rates, northeastern Illinois: summary of year 2 activities. Proceedings of 12th Annual Conference of Illinois Groundwater Consortium, April 22, 2002, <http://www.siu.edu/worda/igc/proceedings/>.

Meyer, S.C., and D.D. Walker. 2002. Review of Northeastern Illinois Ground Water Availability Estimates. [Abstract] National Ground Water Association 2002 Midwest FOCUS Ground Water Conference, Chicago, IL, April 10-12, 2002. NGWA Program with Abstracts, page 3.

Nelson, R.S., Pugin, A.J.M., and Larson, T.H, 2002. Illinois State Geological Survey - Illinois State University collaborative geophysical project. GSA Abstracts with Programs, **34** (6): 468. (abstract)

Panno, S.V, W.R. Kelley, C.P. Weibel, I.G. Krapac, and S.L. Sargent, 2003. Water Quality and Agrichemical Loading in Two Groundwater Basins of Illinois' Sinkhole Plain, Illinois State Geological Survey Environmental Geology 156.

Panno, S.V., K.C. Hackley, H.-H. Hwang, and W.R. Kelly, 2002. Distribution and sources of heterotrophic bacteria in wells, caves, and springs of a karst aquifer in the Midwestern U.S., in Proceedings of Karst Frontiers: Florida and Related Environments, Karst Water Institute Special Publication 7: Hydrogeology and Biology of Post-Paleozoic Carbonate Aquifers, p. 92-94.

Panno, S.V., K.C. Hackley, H.-H. Hwang, S. Greenberg, I.G. Krapac, S. Landsberger, and D.J. O'Kelly, 2002. Determination of the sources of Na and Cl contamination in natural waters: Preliminary results, Proceedings of the 12th Annual Research Conference of the Illinois Groundwater Association, Carbondale, IL, 26 p., published on-line at: <http://www.siu.edu/orda/igc/proceedings/02/panno.pdf>

Panno, S.V., Hackley, K.C., Kelly, W.R., Hwang, H.H., 2002. Sources of nitrate in the Mississippi River adjacent to Illinois. *GSA Abstracts with Programs*, **34** (6): 116 (abstract).

Pugin, A.J.M., Larson, T.H., Sargent, S.L., Sieving, J., Stumpf, A., Young, T.C. and Nelson, R.S., 2002. Geophysical mapping of the Teays-Mahomet Bedrock Valley reveals possible hydraulic window. *GSA Abstracts with Programs*, **34** (6): 228 (abstract).

Pugin, A.J.M., and T.H. Larson, 2002. High-resolution seismic imaging of glacial terrains in Illinois, hydrogeologic resource management applications, in Abstracts with Program of the Southeastern and North-Central Sections Annual Meeting, Geologic Society of America, Lexington, KY, April 3-5, 2002, **34** (2): A-90. (abstract)

Ray, C., T.W. Soong, Y.Q. Lian, and G.S. Roadcap, 2002. Dynamics of flow and transport at bank filtration sites. *J. Hydrology* **266**: 235-258.

Roadcap, G.S., and S.D. Wilson, 2003. Combining and Post-Auditing Existing Sub-regional and Inverse Models to Create One Model that Represents the Geology, Recharge, and Flow in the Entire Mahomet Aquifer. Proceedings of MODFLOW and More 2003, Understanding through Modeling, Volume II: 500–504, September 2003, Golden, CO.

Roadcap, G.S. and S.D. Wilson, 2002. Groundwater Modeling of the Mahomet Aquifer: From Conceptual Models to Post-Audits. [Abstract] National Ground Water Association 2002 Midwest FOCUS Ground Water Conference, Chicago, IL, April 10-12, 2002. NGWA Program with Abstracts, page 36.

Roadcap, G.S., 2003. Application of Nitrogen and Oxygen Isotopes to Identify Sources of Nitrate. *In Research on Agricultural Chemicals in Illinois Groundwater: Status and Future Directions XII, Proceedings of the Twelfth Annual Illinois Groundwater Consortium Conference*, Makanda, IL, April 22, 2003. (<http://www.siu.edu/orda/igc/proceedings/02/roadcap.pdf> accessed June 16, 2003).

Sieving, J.C., W.S. Dey, B.B. Curry, D.A. Keefer, and C.C. Abert, 2003. Geologic Mapping for Groundwater Applications in Kane County, IL, 2003. The Geological Society of America, 37th Annual Meeting of the North-Central Section, 2003 Abstracts with Programs, Volume 35, No. 2, Kansas City, MO, February 2003, p. 8. (Abstract)

Smith, E.C., and R.C. Vaiden, 2002. Regional geologic characterization and mapping using computerized log information: an example from southwestern Illinois, in Abstracts with Program of the Southeastern and North-Central Sections Annual Meeting, Geologic Society of America, Lexington, KY, April 3-5, 2002, Vol. 34, No. 2, p. A-18. (abstract)

Vaiden, R.C., E.C. Smith, and T.H. Larson, 2003. Groundwater geology of DeKalb County, Illinois with emphasis on the Troy Bedrock Valley, Illinois State Geological Survey Environmental Geology 157, in press.

Walker, D.D., S.C. Meyer, and D. Winstanley, 2003. Uncertainty of estimates of groundwater yield for the Cambrian-Ordovician Aquifer in northeastern Illinois, in: *Proceedings of Probabilistic Approaches and Groundwater Modeling*, Am. Soc. Civil Eng., Env. and Water Resources Inst. Symposium, Philadelphia.

Walker, D.D., and R.M. Roberts. 2002a. Summary of Flow Dimensions Corresponding to Hydrogeologic Conditions. In *Proceedings of Bridging the Gap between Measurement and Modeling in Heterogeneous Media*, IAHR International Groundwater Symposium, Berkeley, CA. CD-ROM.

Walker, D.D., and R.M. Roberts. 2002b. Applications of Well Test Derivatives and Flow Dimension Analysis to Midwestern Aquifers. [Abstract] National Ground Water Association 2002 Midwest FOCUS Ground Water Conference, Chicago, IL, April 10-12, 2002. NGWA Program with Abstracts, page 25.

Walker, D.D., and Roberts, R.M., 2002c. Summary of Flow Dimensions Corresponding to Hydrogeologic Conditions. In *Proceedings of Bridging the Gap between Measurement and Modeling in Heterogeneous Media*, IAHR International Groundwater Symposium, Berkeley, California, p 295. CD-ROM.

Wehrmann, H.A., D.D. Walker, and D. Winstanley. 2002. Modeling the Aquifers of Illinois: How Do We Get There From Here? [Abstract] National Ground Water Association 2002 Midwest FOCUS Ground Water Conference, Chicago, IL, April 10-12, 2002. NGWA Program with Abstracts, page 26.

Willems, B.A., T.H. Larson, A.J.M. Pugin, and D.H. Malone, 2002. A geophysical investigation into the lithology and stratigraphy of the Mahomet Buried Valley, Piatt County, IL. GSA Abstracts with Programs, **34** (6): 23. (abstract)

Willems, B.A., T.H. Larson, A.J.M. Pugin and D. H. Malone, 2002. A geophysical investigation into the lithology and stratigraphy of the Mahomet Buried Valley, Piatt County, IL. Geological Survey of Canada Open File 1449, p. 79-86. (abstract)

Wilson, S.D., W.R. Kelly, T. Holm, and G. Roadcap. 2002. Distribution of Arsenic in the Mahomet Aquifer in Central Illinois. [Abstract] National Ground Water Association 2002 Midwest FOCUS Ground Water Conference, Chicago, IL, April 10-12, 2002. NGWA Program with Abstracts, page 38.

Zhou, J., C. Lundstrom, B. Fouke, S.V. Panno, and K. Hackley, 2002. 234U 238U disequilibrium and trace elements in groundwater through time: a speleothem record from southern Illinois. GSA Abstracts with Programs, **34** (6): 397. (abstract)

Appendix II:

**Water Supply Planning and Management Projects for the Illinois State Water Survey  
*related to implementation of the***

**DNR Integrated Water Quantity Planning and Management Program**

December 17, 2003

**Statewide Management**

**Water supply web site** - The Water Survey (ISWS) has developed a new web site for water supply information. This can be accessed via the Internet at <http://www.sws.uiuc.edu/docs/wsfaq/> . The web site is intended to be the primary decision support site in the state for water supply information. Answers to key questions are provided and the site contains many maps, diagrams, and datasets on every aspect of water supply including climate variability and change, surface waters, groundwater, and social, economic and legal issues. There are also many hot links to other sites at the Water Survey, Illinois state agencies, professional organizations, and in other states.

**Climate studies** - Surface water and groundwater supplies are fed by precipitation and variations in precipitation from year-to-year and decade-to-decade can greatly affect water availability. Studies of climate variability and change have been a core area of ISWS research for decades. There has a particular focus on variations in precipitation, including extreme events, and on the levels of the Great Lakes. Three specific research thrusts are particularly noteworthy. The frequency and intensity of extreme precipitation events have exhibited considerable temporal variability. Several publications of the Water Survey have documented an increase during the last two decades. However, a recently published paper by the ISWS indicates that frequencies were also high around the beginning of the 20<sup>th</sup> Century, indicating that natural variations are substantial.

The use of water from Lake Michigan is of critical importance to Illinois, and past fluctuations in lake levels have brought major economic impacts and legal problems to Illinois. A 141-yr study of the fluctuations on Lakes Michigan-Huron, Superior and Erie was recently undertaken. Lakes Michigan has a U-shaped water level distribution, being high early (19<sup>th</sup> Century), lowest in the 1930s, and high late in the 20<sup>th</sup> Century. There were two distinct periods of great fluctuations and change that occurred on: 1923-1938 and 1973-2001.

Both natural and human-induced climate change poses a threat to future water supplies, but there remains great uncertainty about the magnitude of such potential changes. In order to address this issue, the ISWS is developing a regional climate model that is being used to develop plausible scenarios of future Illinois climate.

**Planning for a worst-case drought** - States such as California, Texas, Colorado and Texas have experienced adverse impacts from major droughts in recent years, droughts for which they were not sufficiently prepared. Major droughts occurred in Illinois in the 1930s and 1950s and, hence, most people can not recall them. Since this time, population and the economy have increased and the state is vulnerable to a major drought. Although scientists cannot predict when another major drought will occur, they are certain that one will occur. One of the ways in which Illinois can prepare itself for the next major drought is for climatologists to quantify from the historical record precipitation deficits that can be expected. And scientists at the ISWS are doing just this. Once drought scenarios have been developed, these can be translated into reduced water availability in lakes, reservoirs, rivers, and shallow aquifers, and to increased water demand. In turn, water supply managers will be able to evaluate the capacity of existing water systems to deal with such droughts. If potential problems are identified, then alternatives can be identified and implemented at appropriate levels of risk and cost to each community.

The proposed update on the adequacy of surface water systems would identify the PWS systems that will be at risk of failing to provide sufficient water during worst-case droughts, and propose alternative source of supply for regions/communities if their water supplies fail. The ongoing analysis for the ILSAM models also provides much of the basic data needed to evaluate water resources availability during droughts of record, that being climatic/hydrologic conditions on the same magnitude as occurred during the severe droughts of the 20<sup>th</sup> century. Future strategies should focus not only on the water-resource aspects of worst-case droughts, but also on the institutional aspects and limitations of dealing with water supply shortages, particularly for large communities.

**Illinois Water Inventory Program (IWIP)** - The ISWS has been collecting water use and water availability data for Illinois since at least the early 1940s, primarily in regions where water resources were being extensively developed. Documentation of annual water withdrawals (water use) for all of Illinois began in 1978 under a cooperative agreement with the U.S. Geological Survey (USGS). Fiscal support by the USGS ended in 1991 but the Illinois Water Inventory Program (IWIP) continues under the general oversight of the Groundwater Section of the ISWS. Withdrawal data are collected annually by voluntary submission of a form tailored to each (known) major water user in the state. For the Year 2000, for example, IWIP received a 70 percent return on inquiries sent to 2,832 facilities. Information on the quantity of water withdrawn (both surface water and groundwater) is generally categorized as: Public Water Supply; Self-Supplied Industry - such as thermoelectric power generation, manufacturing, mineral extraction, and hydroelectric power generation; and Other which includes withdrawals for fish and wildlife management areas and irrigation.

**Water Supply System Capacity and Demand Forecast** - The Midwest Technology Assistance Center (MTAC) has funded a project through Southern Illinois University at Carbondale to develop a county-wide assessment of water supply capacity and future demand for Illinois and the rest of EPA Region V. The tasks of this project include the collection of relevant water use data and identification of the water supply capacity of the existing water supply systems. This assessment is being performed on the basis of the capacity of the treatment plant and distribution systems only. This study is not assessing the reliability of the raw water supply source. Another project task is the development of a water use model for use by system operators in order to assist in planning and decision making, useful as a tool in answering questions pertaining to subjects such as water rates and projections on use and demand. The study will provide demand forecasts on a county-level basis for 2005, 2010, 2015, 2020 and 2025. This study is scheduled for completion in early 2004.

### **Statewide Surface Water**

**Adequacy of surface water supply systems** - An update of the 1989 study “Adequacy of Illinois Surface Water Supply Systems to Meet Future Demands,” by Sally McConkey and Kris Singh, is needed to address many of the water supply management issues in central and southern Illinois. Associated with the update of this study is the need to replace the two hydrologic design manuals for impounding and side-channel reservoirs, ISWS Bulletins 66 and 67, which provide the basic hydrologic information used to estimate water supply system yield in the 1989 study. These two Bulletins were prepared using hydrologic data collected through 1978, and it is essential that any updated analysis of surface water system yields use the additional 25 years worth of hydrologic data that has been collected since 1978. The ongoing development of the ILSAM models for Illinois watersheds supported by OWR provides the basic drought flow information and framework needed for replacing these Bulletins, and an extension of the ILSAM models for determining reservoir yield is envisioned. Additional work that is needed includes contacting operators/managers for each public water supply system that uses surface water to obtain information on current facilities, recent history of water use, communities and populations served, plans for future changes, and plans for dealing with water supply shortages, if they exist. Consideration should be given to evaluating water supply yields under “worst-case” or “drought of record” scenarios in addition to the standard drought recurrence intervals of 25- and 50-years.

**Instream flow assessment** - Defining instream flow needs for aquatic ecosystems, navigation, and recreation is crucial to determining the availability of surface water resources during drought conditions. Although instream demands must often be defined by biologists, determination of protected flow levels must also be based on hydrologic considerations, such as how much water is available, how often, and at what times of the year. The ISWS has previously conducted analysis to define streamflow frequency for protected flow levels, as presented in two reports, “Pertinent Considerations in the Development of Protected-streamflow Criteria for Illinois Streams” (Contract Report 431) and “Information on Availability of Water for Withdrawals from Illinois Streams at Various Protected-flow Levels” (Contract Report 414), and is in a unique position to update and improve such studies and analyze the hydrologic aspects of protected flow.

## **Statewide Groundwater**

**Statewide aquifer use-to-yield analysis** - Proper water resource planning and management requires a firm understanding of water use and water resource availability. The ISWS has conducted a comparison of Year 2000 groundwater withdrawals against estimated aquifer potential yields. The comparison is presented as a ratio of groundwater use (withdrawals) to groundwater yield (i.e., potential aquifer yield) on a township basis. Geographical Information System (GIS) technology was used to determine township use-to-yield ratios for three aquifer types (sand-and-gravel, shallow bedrock, and deep bedrock). A high use-to-yield ratio (e.g., >0.9) suggests an area where groundwater availability problems exist or could be impending.

The delineation of high groundwater use-to-yield areas by this method should be considered as a means for calling attention to areas to prioritize on a statewide basis for water resources planning and management.

**Arsenic in Illinois groundwater** - In 2001, the U.S. EPA lowered the arsenic maximum contaminant level (MCL) for arsenic in drinking water from 50 micrograms per liter ( $\mu\text{g/L}$ ) to 10  $\mu\text{g/L}$  to be effective by 2006. The IEPA estimates that approximately 50 Illinois utilities that use groundwater as their water source may be out of compliance without additional treatment. And, though unregulated, thousands of private wells are likely to exceed this health-based standard. To address this issue, the ISWS is conducting research on the occurrence and distribution of arsenic in community, non-community, and private wells in Illinois as well as possible treatment alternatives for arsenic removal. Further, the ISWS provides free arsenic analysis of water samples submitted by private citizens to the Public Service Lab.

**Aquifer testing for water supplies in Illinois** - The ISWS has been collecting and evaluating data on groundwater resources for more than a century. One of the most unique services provided by the ISWS is conducting aquifer tests for communities and large facilities to provide estimates of well and aquifer yield. The data collected over the last century are invaluable for examining the availability of groundwater across Illinois. Testing typically consists of pumping a well at a constant rate and measuring the groundwater level decline in the pumped well and nearby observation wells, if available. Most tests are conducted over a pumping period 3 to 24 hours. Within the last two years, aquifer tests have been conducted on new wells drilled for Ninovan Lake Estates (Grundy County), Cropsey (McLean County), Dawson and Chatham-Rochester Water Commission (Sangamon County), Goose Creek Energy (peaker power plant in Piatt County), Gifford (Champaign County), Lone Willow Farms (hog confinement facility in Woodford County), and Paris (Edgar County). In addition, a 30-day-long test was conducted as part of ISWS research on the Mahomet aquifer near Monticello (Piatt County).

**Water well record keeping** - Another long-term effort at the ISWS involves archival of construction reports for all water wells drilled in Illinois. Data on the construction reports includes well location, owner, driller, depth of well, well yield, water level when the well was drilled, and geologic formations penetrated. While historical water well data are known to be incomplete, the ISWS possesses records for over 300,000 water wells drilled in Illinois since the turn of the 20<sup>th</sup> Century. The ISWS receives numerous calls from the public on a daily basis for copies of records or for interpretation of information contained on these records.

**Groundwater level observation network** - The ISWS maintains various networks of observation wells for groundwater-level monitoring. One statewide network of about 30 wells is being used to evaluate long-term trends in the water table. Strategically located away from pumping centers, these data provide a link between climate conditions and shallow groundwater levels. Other networks are used to provide periodic glimpses of aquifer conditions as a result of development, such as in the Mahomet aquifer in east-central Illinois and other aquifers beneath Illinois. Water levels in approximately 400 wells completed in the deep bedrock aquifer wells are measured collectively every five years - the last measurement was in 2000 and the next will be in 2005. Mapping of these water levels has shown a recovery of water levels in areas where Lake Michigan water has been allocated, but continued declines in the Aurora-Joliet area where large withdrawals continue to occur. This data is extremely valuable for assessing water resource availability and is essential for calibration of groundwater models.

**Increasing access to groundwater data** - A cooperative effort between the ISWS and the Illinois Environmental Protection Agency (IEPA) is enhancing access to three important statewide databases on groundwater quality, aquifer hydraulic properties, and water use in Illinois maintained by the ISWS. Very few such statewide databases on groundwater even exist in other states. An ISWS Internet Map Server (IMS) site has been developed to improve internal accessibility to the ISWS databases in a manner similar to the IEPA's Source Water Assessment and Protection (SWAP) site. The Illinois Water Inventory Program database is already on the ISWS IMS site, and the Groundwater Quality database will be soon. The Aquifer Hydraulic Properties database will be on the site by early 2004. The ISWS and IEPA sites are not accessible to the general public because the databases contain public well locations and other sensitive data that raise homeland security issues. The sites are, however, accessible to scientists at the ISWS and other state agencies, which has improved response to public inquiries. Improved data access will also greatly enhance scientific analysis of the data by allowing users to map specified data, view the map on screen, print the information, and download specified data for further analysis.

### **Northeastern Illinois Management**

**Southern Lake Michigan Water Supply Consortium** - Illinois recognizes that many water supply issues can best be addressed at the regional level with much local input. A regional approach focuses on whole watersheds and whole aquifers and cuts across political boundaries. Northeastern Illinois is one of the priority areas in the state. The ISWS is working closely with the Northeastern Illinois Planning Commission, representatives from local, state and federal agencies, professional organizations, universities, and the business community to establish an organizational structure and process for water supply planning around southern Lake Michigan. Several planning meetings have been held in Chicago and a detailed plan for regional water supply planning is being developed. Components of the plan will include education and outreach, scientific studies, and funding. With support from the Joyce Foundation, a water supply conference will be held in 2004.

**Chicago area rain gage network** - The Cook County Precipitation Network is a 25-site weighing-bucket raingage array operated year-round since 1989 by the Illinois State Water Survey for the U. S. Army Corps of Engineers (COE). The network is located in the Lake Michigan and Des Plaines River watersheds of Cook County and is laid out in a grid with a spacing of approximately 10 km between gages. Precipitation is recorded electronically at 10-minute intervals, downloaded monthly, quality controlled. and hourly precipitation amounts are computed.

The primary purpose of the network is to produce consistent, accurate data for Lake Michigan diversion accounting. The volume of water diverted from Lake Michigan into the state of Illinois is monitored to ensure that the diversion does not exceed a long-term average as imposed by a 1967 U.S. Supreme Court Order, which was updated in 1980. The monitoring procedures are administered by the U.S. Army Corps of Engineers, Chicago District. The diversion is comprised of pumpage from Lake Michigan that is treated for the water supply, direct diversion from the lake into the rivers and canals, and runoff from the Lake Michigan watershed. The precipitation measurements are crucial to the hydrological simulations used to estimate storm runoff from the both the Des Plaines and Lake Michigan watersheds. Runoff from Lake Michigan can constitute a significant portion (25-30 percent) of the diversion.

### **Regional/Local Surface Water**

**Water use planning and management for the Fox River** - The ISWS is currently involved in two projects that will play a crucial role in water use planning and management for the Fox River: 1) the water quality evaluation of the Fox River being conducted for the Fox River Study Group, and 2) the water resource evaluation study for Kane County, which has a surface-water accounting component. Phase one of the water quality study is complete and additional multi-year phases have been proposed. Water quality models of the Fox River watershed will be developed and used as tools for water quality management. This work is also linked to the second project, the proposed surface-water accounting model for the Fox River which is scheduled for development in 2005. The ILSAM (Illinois Streamflow Assessment Model) for the Fox River will serve as a basis for the interactive flow accounting model. The customized model will include enhanced modeling options and post processing of generated flow data. Once identified, water quality constraints will be incorporated into the surface water accounting and availability model. These studies will need to be expanded and/or additional issues addressed for developing a water supply management plan for the entire Fox River region.

## **Regional/Local Groundwater**

**Assessment of water resources availability for Kane County** - The ISWS and Illinois State Geological Survey are jointly conducting a series of hydrologic and geologic studies to provide technical support for management and protection of water resources in Kane County. Specific objectives of the research are to help preserve groundwater availability, protect groundwater quality, provide a basis for formulating policy and management strategies for Kane County's water resources, and also provide baseline data and a framework for future studies in Kane County. This past year, the ISWS inventoried, surveyed and measured water levels in over 1,000 public and private shallow aquifer wells. The water-level data will be used to create potentiometric surface maps depicting groundwater elevations in sand-and-gravel and shallow bedrock aquifers. These maps will provide irreplaceable baseline data for identification of changes in groundwater levels from increased withdrawals, land-use changes, or climate change. They also will be used to calibrate groundwater flow models of the shallow aquifers.

**Groundwater modeling in northeastern Illinois** - Groundwater modeling activities for northeastern Illinois include assembling an interstate geological framework, building a database of historical water withdrawals by aquifer, and assembling data for a regional three-dimensional computer model from the aquifers' deepest layers of pre-Cambrian bedrock to the land surface. Modeling will help scientists interpret hydrologic and geologic data, and also provide analytical tools to quantify groundwater resources in the shallow and deep aquifer systems. Models will be used to estimate recharge rates, leakage between aquifers, aquifer responses to increased aquifer development, and aquifer yields; assess surface water/groundwater interactions; evaluate alternative management scenarios; and establish a framework for future modeling studies. The proposed modeling consists of two high-resolution groundwater flow models at a local scale nested within a lower resolution regional model of northeastern Illinois. The regional model will be used to evaluate regional flow patterns, provide boundary conditions for local models, and estimate yields from the deep bedrock aquifer system. Embedding a local model of the deep aquifer system in the regional model will allow evaluation of well interference impacts between individual high-capacity public supply wells finished in the deep bedrock aquifer system. The nested model also will provide a framework for future models of the deep aquifer system. A second local model embedded in the regional model will be used to provide a high-resolution representation of the shallow aquifer system underlying Kane County. This model or set of models will be used to estimate and map shallow aquifer groundwater availability, recharge, and discharge rates in Kane County; delineate capture zones surrounding high-capacity public water-supply wells, and assess groundwater/ surface water interactions.

**Water quality trends in shallow groundwater in northeastern Illinois** - The rapid increase in population and developed land in the Chicago metropolitan area has placed a heavy demand on water resources. Owing to legal restrictions and natural limitations on the availability of additional water from Lake Michigan and the region's deep aquifer system, the most cost-effective option for future water development in the region is likely to be the shallow aquifers. The shallow aquifers of the region are vulnerable to surface-derived contaminants, and the increase in developed land may be increasing the rate at which groundwater quality is being degraded. Historical shallow groundwater chloride (Cl<sup>-</sup>) concentrations from the Chicago metropolitan area are being assessed for data quality and temporal trends.

Chloride concentrations are increasing in municipal wells in the outermost counties of the Chicago metropolitan area, with road salt runoff likely the largest source of contamination. Approximately 16 percent of the samples collected from municipal wells in northeastern Illinois in the 1990s had Cl<sup>-</sup> concentrations greater than 100 mg L<sup>-1</sup>; median values were less than 10 mg L<sup>-1</sup> prior to 1960, before extensive road salting.

**Mahomet aquifer and the Mahomet Aquifer Consortium** - The Mahomet Aquifer Consortium is a grass-roots, not-for-profit organization whose goal is to manage the water resources in the Mahomet Aquifer. The Mahomet Aquifer is the major groundwater resource for east-central Illinois. Many communities, industries, and irrigators depend on the aquifer for their supply; withdrawals in 1995 for municipal use are estimated at over 30 mgd. Withdrawals for irrigation, principally in Mason and Tazewell counties (the Havana Lowlands area), put usage well over 100 mgd. Long-term observations of groundwater levels at Champaign show a decline in artesian head of nearly 50 feet since 1950, as a result of increasing water demand in the Champaign-Urbana area. Similar, perhaps greater, declines can be expected in other areas of development as use of the aquifer increases. Projections suggest that by 2020 population in the Mahomet aquifer region may increase by 100,000 people. ISWS scientists serve as technical advisers to the Consortium and are preparing a computer model of the aquifer to examine the effects of increased development and to provide insight on development alternatives. Computer models require volumes of data and ISWS scientists are constantly acquiring new data to complement historical data.

**Modeling aquifer heterogeneity: NCSA Fellowship** - Fractured dolomite aquifers are among a series of bedrock aquifers that are part of the drinking-water supply for the greater Chicago area. However, groundwater flow and contaminant transport in fractured rock systems are notoriously difficult to characterize because the features conducting flow do not necessarily fill the available volume that porous media (e.g., sand-and-gravel) typically do. The ISWS is conducting research on the characterization of fractured dolomite aquifers through the advanced analysis of hydraulic and tracer tests. The goal of the project is to determine the relationship between the flow dimension inferred from hydraulic tests, stochastic models of heterogeneous transmissivity, and the behavior of tracer tests and thus identify plausible models of aquifer heterogeneity. Support is being provided, in part, from the National Center for Supercomputing Applications.

**Water levels, precipitation, and recharge in the Imperial Valley - Mason & Tazewell Counties** - The ISWS has operated a network of rain gauges in Mason and Tazewell Counties since August 1992. The ISWS also established a network of groundwater observation wells in the Mason-Tazewell area in 1994 that is monitored by the IVWA. The purpose of the rain gauge network and the groundwater observation well network is to collect long-term data to determine the impact of groundwater withdrawals in dry periods and during the growing season, and the rate at which the aquifer recharges. Precipitation is recorded continuously at 20 rain gauges. Groundwater levels are measured the first of each month at 13 observation wells. The database from these networks consists of 10 years of precipitation data and eight years of groundwater observations.

## **Statewide Education and Outreach**

**“Water Choices” - an educational tool** - Water Choices is an educational computer program developed by the ISWS as an aid in teaching concepts of water resources. It presents the student with a hypothetical stream – wetland – aquifer system and calculates the impacts of management decisions on a wetland, streamflow, and groundwater levels. “Water Choices” is distributed with scenarios that illustrate specific water resources concepts, including Moderate Development (the default), Predevelopment, Climate Change, and Competitive Usage scenarios. “Water Choices” was developed under a grant from the Illinois State Board of Higher Education.

Appendix III:

**GROUNDWATER EDUCATION PROGRAM SURVEY RESULTS:**

A survey was conducted in 2003 of over 100 persons (mostly from regional committees) directly involved in groundwater protection, but not from state or federal agencies. As in the past, the tabulated results were used by the Education Subcommittee in evaluating the past program, developing its annual work plan, and setting priorities. Key survey findings indicate this program should aim at private well owners and Illinois teachers as our highest priority, with professionals, elected officials and association representatives close behind. The lowest priority audiences as rated by the respondents were the regulated business community and the general audience.

Respondents prioritized five potential initiatives. The highest rated priority was for education programs in areas affected by groundwater contamination. Programs related to abandoned wells and revisiting county based groundwater workshops for teachers were close behind in priority rating. Nitrate education and a groundwater science DVD were the lowest rated priorities. Survey respondents also affirmed the most cost-efficient means of reaching the various audiences is by going to their meetings and by writing targeted articles for existing newsletters.

**Biennial Statistical Summary:** Review and analysis of annual groundwater educational reports for the July 2001 thru June 2003 report period, provided the following information, trends, and discussion.

<b>Teacher contacts in workshops:</b>	<u>921</u>	Significant upward trend reflects success in working through regional offices of education and local agencies for in-service teacher education.
<b>Teacher contacts through exhibits:</b>	<u>4,644</u>	Downward trend since we have focused on meetings of science and agriculture teachers, not general teacher meetings, such as those in Quincy, Mt. Vernon, Bloomington, or Effingham.
<b>Regional and state planning meetings:</b>	<u>61</u>	Significant downward trend. To foster communication and coordination with local and regional groundwater leaders, education staff participated in these meetings when not on other groundwater education missions.
<b>Days devoted to these meetings:</b>	<u>48</u>	These committees have matured and no longer require monthly or bi-monthly assistance or updates. Due to their distance from Springfield, most of these meetings required a full day to participate in a two to three hour meeting, consequently staff often scheduled other business or events to efficiently use this travel time.

**Student contacts through field days:** 37,514

**Teacher contacts through field days:** 1,304

**Days devoted to field days:** 104

These contacts and days more than doubled over the past two years, due to the great popularity and growth of these county or multi-county field or stewardship days, usually sponsored by UI Extension, SWCD's, park districts, health offices, and other local organizations. In a typical field day, groundwater staff provided six to 15 classes of students, their teachers and some parents with a 15 to 30 minute groundwater science presentation. The presentation covered the water cycle, groundwater model demonstrations, open-land and urban water budgets, scientific methods related to groundwater, groundwater protection, and a water conservation game. All teachers were provided with teaching materials and methods, and students with information on groundwater testing and protection to take home. Most field days were held outdoors at parks or fairgrounds in the spring and fall months. Ongoing evaluations of this program by teachers and field day organizers helped improve it and document its high energy and educational value. Students from over 50 counties of Illinois were served in both years. Since staff reached over 18,000 students per year, since the field days were aimed at a particular grade level, and since there were about 180,000 students at any one grade level in Illinois, this field day station approach reached about 10 percent of the potential "market", a remarkable achievement, when considering less than two staff equivalents were involved. Staffing is primarily from DNR, but also from IDPH and increasingly from local health and water agencies.

<b>Professional conference presentations:</b>	<u>28</u>	<p>Although the time and presentations trended downward, the contacts increased by about a 1,000 each year over the past three years. As the groundwater protection program was institutionalized, it was found that statewide meetings were much more efficient uses of available resources than regional meetings. The most efficient use of staff and travel resources is at large statewide meetings such as those of the Illinois Municipal League (IML), Illinois Potable Water Supply Operators Association (IPWSOA), Illinois Environmental Health Association (IEHA), Illinois Section of the American Water Works Association (ISAWWA), Illinois Fertilizer and Chemical Association (IFCA), and Illinois Association of Groundwater Professionals (IAGP). When requested, services are still provided to the regional groups, but statewide meetings allow very efficient use of extremely limited staff resources.</p>
<b>Professional contacts at these meetings:</b>	<u>9,335</u>	
<b>Days devoted to these conferences:</b>	<u>58</u>	
<b>Award Presentation Days:</b>	<u>9</u>	<p>Steady trend. The Shining Star Awards program for Groundwater Protection presented framed certificates of achievement and lapel pins to local governments for protecting groundwater resources. About five days a year were devoted to develop and present these awards, typically at local meetings to secure press coverage. The Shining Star Award announcements included a detailed description of exemplary governmental activities and provided models for other units of government. Shining Stars included 17 local units of government over the past six years. The future of this award program remains uncertain due to the travel and material costs for the presentations. There is currently no sponsor or non-governmental organization interested in picking up this award program. Another awards program for professional groundwater science achievements was turned over to the Illinois Groundwater Association, which administers and presents the awards at their meetings. For more information on this program, see <a href="http://www.iga.uiuc.edu/gwawards.html">http://www.iga.uiuc.edu/gwawards.html</a></p>

**General adult contacts at fairs and field days:**

10,670

**Days devoted to these events:**

61

The upward trend in contacts over the last several years reflected the commitment of IDPH, IDNR, and IAGP to the Water Well Clinics at the Illinois state fairs in Springfield and DuQuoin. IDOA also developed a groundwater protection and well sealing exhibit at Watershed Park in the Springfield State Fairgrounds. Well owners eager for information returned year after year to discuss problems with their wells and water systems. Previous visitors referred many well owners to this clinic. Frequently they requested water testing and well disinfection information. With an estimated 400,000 private well owners in Illinois, probably less than one in 80 was reached through this state level program, and no records are kept of water well inquiries to local agencies. Partnerships with trade and professional associations provided a great deal of resources and staffing; due to work rules, state employee weekend time was largely volunteered.

**Total days for outside meetings:**

326

**Total contacts:**

64,424

Contacts increased significantly while days out decreased slightly. Severe cutbacks in travel budgets and staff available required the most efficient use of resources, and volunteers were secured when possible. Much more travel was outside of work hours. Through FY 03, cross training and borrowing of staff from other programs during busy times of the year helped cover the workload. Recent administrative and budgetary restrictions have made this difficult, if not impossible. To meet the legislated mandate for groundwater protection education, groundwater education cannot be conducted in a Springfield office, but needs to continue being in the field a majority of the time. The very high level of 32,000 total annual contacts cannot be sustained without new resources. Consequently, with dwindling staff and travel, the future of the program remains uncertain.

*Appendix IV:*

**Groundwater and Related Publications by the United States Geological Survey**

Groschen and others, 2000, Water Quality in the lower Illinois River Basin, Illinois, 1995-98 U.S. Geological Survey Circular 1209, 36 p.

Kay, R.T., 2000, Geology, hydrology, and ground-water quality of the Galena-Platteville aquifer in the vicinity of the Parson's Hardware Superfund site, Belvidere, Illinois: U.S. Geological Survey Water-Resources Investigations Report 00-4152, 34 p.

Kay and others, 2002, Use of isotopes to identify sources of ground water, estimate ground-water-flow rates, and assess aquifer vulnerability in the Calumet region of northwestern Indiana and northeastern Illinois: U.S. Geological Survey Water-Resources Investigations Report 02-4213, 60 p.

Kay and others, 2003, Concentrations of polynuclear aromatic hydrocarbons and inorganic constituents in ambient surface soils, Chicago, Illinois: 2001-02: Morrow, W.S., 2003, Anthropogenic constituents in shallow ground water in the upper Illinois River Basin: U.S. Geological Survey Water-Resources Investigations Report 03-4105, 79 p.

Mills and others, 2002, Hydrogeology and simulation of ground-water flow in the aquifers underlying Belvidere, Illinois: U.S. Geological Survey Water-Resources Investigations Report 01-4100, 103 p.

Mills and others, 2002, Delineation of the Troy Bedrock Valley and particle-tracking analysis of ground-water flow underlying Belvidere, Illinois: Morrow, W.S., 2003, Anthropogenic constituents in shallow ground water in the upper Illinois River Basin: U.S. Geological Survey Water-Resources Investigations Report 02-4062, 46 p.

Morrow, W.S., 2003, Anthropogenic constituents in shallow ground water in the upper Illinois River Basin: U.S. Geological Survey Water-Resources Investigations Report 02-4293, 34 p.

Robl and others, Water Resources Data—Illinois, Water Year 2002: U.S. Geological Survey Water-Data Report IL-02, CDROM.

Warner, K.L., 2001, Arsenic in glacial drift aquifers and the implication for drinking water—lower Illinois River basin, *Ground Water*, v. 39, no. 3, p. 433-442.

Warner and others, 2003, Arsenic in Illinois ground water—community and private supplies: U.S. Geological Survey Water-Resources Investigations Report 03-4103, 12 p.

Appendix V.

**Additional Reports Developed by or for the Illinois EPA 2002/2003**

Beck, Roger C., and Sanders, Laura L., 2002, *Delineation of Wellhead Protection Areas for Aurora, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Boateng, Samuel, 2001, *Well Head Protection Area Delineation for Meredosia Community Water Supply Facilities*, Illinois State University, Normal, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Booth, Colin J., 2001, *Modeling and Delineation of the Five-Year Recharge Area for the Borden CWS Facility 1675110, Sangamon County, Illinois*, Northern Illinois University, DeKalb, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Booth, Colin J., 2001, *Modeling and Delineation of the Five-Year Recharge Area for the Colona West (Green Rock) CWS Facility 0730550, Henry County, Illinois*, Northern Illinois University, DeKalb, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Booth, Colin J., 2001, *Modeling and Delineation of the Five-Year Recharge Area for the Congerville CWS Facility 2030100, Woodford County, Illinois*, Northern Illinois University, DeKalb, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Booth, Colin J., 2001, *Modeling and Delineation of the Five-Year Recharge Area for the London Mills CWS Facility 0574620, Fulton County, Illinois*, Northern Illinois University, DeKalb, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Booth, Colin J., 2001, *Modeling and Delineation of the Five-Year Recharge Area for the Tallula CWS Facility 1290250, Menard County, Illinois*, Northern Illinois University, DeKalb, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Booth, Colin J., 2001, *Modeling and Delineation of the Five-Year Recharge Area for the Mount Pulaski CWS Facility 1070400, Logan County, Illinois*, Northern Illinois University, DeKalb, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Booth, Colin J., 2001, *Delineation of the Five-Year Recharge Area for the Emergency Well #3, IEPA #50220, Supplement to the Recharge Area Delineation Report for Mount Pulaski CWS Facility 1070400, Logan County, Illinois*, Northern Illinois University, DeKalb, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Booth, Colin J., and Cuplin, Shane, 2001, *Modeling and Delineation of the Five-Year Recharge Area for the Curran-Gardner CWS Facility #1675350, Sangamon County, Illinois*, Northern Illinois University, DeKalb, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Booth, Colin J., and Cuplin, Shane, 2002, *Modeling and Delineation of the Five-Year Recharge Area for the Petersburg CWS Facility #1290200, Menard County, Illinois*, Northern Illinois University, DeKalb, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Booth, Colin J., and Cuplin, Shane, 2001, *Modeling and Delineation of the Five-Year Recharge Area for the Riverton CWS Facility #1670950, Sangamon County, Illinois*, Northern Illinois University, DeKalb, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Arenzville, Illinois, 2002*, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Bluffs, Illinois, 2002*, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Carrollton, Illinois, 2002*, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Chesterfield, Illinois, 2002*, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Clayton Camp Point Water Commission, 2002*, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Creve Coeur, Illinois, 2002*, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Eldred, Illinois, 2002*, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Farmersville, Illinois, 2002*, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Fillmore, Illinois, 2002*, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Griggsville, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Groveland Township Water District, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Hennepin Public Water District, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Hull, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Jacksonville, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Kane, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Lewistown, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Longview, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Marquette Heights, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Mazon, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Nebo, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: New Canton, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: North Pekin, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Palmer, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Perry, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Pike County PWD (New Canton Plant), 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Pike County PWD (Rockport Plant), 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Plymouth, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Ramsey, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Raymond, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Stewardson, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Tiskilwa, Illinois, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.*

*Delineation of Wellhead Protection Areas: Tower Hill, Illinois*, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Versailles, Illinois*, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Virginia, Illinois*, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

*Delineation of Wellhead Protection Areas: Waggoner, Illinois*, 2002, Rapps Engineering & Applied Science, Springfield, IL, unpublished report to the Illinois Environmental Protection Agency, Springfield, IL.

Devore, Carrie, and Esling, Steven, 2002, *Delineation of a Well Head Protection Area: Anna-Jonesboro Water District, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Devore, Carrie, Keller, John, Miller, Ken and Esling, Steven, 2001, *Delineation of a Well Head Protection Area: Marshall, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Ghosh, Dipanjan, and Esling, Steven, 2001, *Delineation of a Well Head Protection Area: Iuka, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Ghosh, Dipanjan, and Esling, Steven, 2002, *Delineation of a Well Head Protection Area: Robinson-Palestine, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Ghosh, Dipanjan, and Esling, Steven, 2002, *Delineation of a Well Head Protection Area: Vermilion, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Horvath, Danial J., 2002, *Modeling and Delineation of the Five-Year Recharge Area for the Sheffield CWS Facility 0110950, Bureau County, Illinois*, Northern Illinois University, DeKalb, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Johnston, Cindy, and Esling, Steven, 2002, *Delineation of a Well Head Protection Area: St. Rose, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Kinch, Judith, 2002, *Wellhead Protection Delineations of Three Municipal Wells in the City of McHenry, Illinois*, Northeastern Illinois University, Chicago, IL, M.S. thesis, unpublished.

Little, Brandy, Ghosh, Dipanjan, and Esling, Steven, 2002, *Delineation of a Well Head Protection Area: Sidell, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

McGuire, Melissa, Keller, John, Miller, Ken, and Esling, Steven, 2001, *Delineation of a Well Head Protection Area: Hartford, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

McGuire, Melissa, Keller, John, Miller, Ken, and Esling, Steven, 2001, *Delineation of a Well Head Protection Area: Wood River, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

McGuire, Melissa, Keller, John, Miller, Ken, and Esling, Steven, 2002, *Delineation of a Well Head Protection Area: East Alton, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

McManus, Scott, Ghosh, Dipanjan, and Esling, Steven, 2002, *Delineation of a Well Head Protection Area: Casey, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Miller, Ken, and Esling, Steven, 2001, *Delineation of a Well Head Protection Area: Germantown, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Miller, Ken, and Esling, Steven, 2002, *Delineation of Well Head Protection Areas for the Village of Ridgeway, Gallatin County, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Miller, Ken, Ljunggren, Bjorn, and Esling, Steven, 2003, *Delineation of Well Head Protection Areas for the Saline Valley Conservancy District, Gallatin County, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Miller, Sue, and Esling, Steven, 2001, *Delineation of a Well Head Protection Area: South Water, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Miller, Sue, and Esling, Steven, 2001, *Delineation of a Well Head Protection Area: Tamms, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Miller, Sue, and Esling, Steven, 2002, *Delineation of a Well Head Protection Area: Belknap, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Miller, Sue, and Esling, Steven, 2002, *Delineation of a Well Head Protection Area: Karnak, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Phil, Marissa, Scheidt, Brian, Johnston, Cindy, and Esling, Steven, 2001, *Delineation of a Well Head Protection Area: Bartelso, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Radhakrishnan, Prem, Johnston, Cindy, and Esling, Steven, 2001, *Delineation of a Well Head Protection Area: Hindsboro, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Roethe, Eric, Scheidt, Brian, Ghosh, Dipanjan, and Esling, Steven, 2002, *Delineation of a Well Head Protection Area for Old Shawneetown, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., 2001, *Delineation of Wellhead Protection Areas for the Community Water Supply Wells of the Village of Greenup, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., 2001, *Delineation of a Wellhead Protection Area for the Community Water Supply Wells of the Village of Toledo, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., and Bohac, Amy M., 2001, *Delineation of Wellhead Protection Areas for Community Water Supply Wells of the Clear Water Service Corporation, Coles County, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., and Bohac, Amy M., 2001, *Delineation of Wellhead Protection Areas for Community Water Supply Wells of Cooks Mills, Illinois*, Northeastern Illinois University, Chicago, IL report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., and Ianeva, Margarita. B., 2002, *Delineation of Wellhead Protection Areas for the Utilities, Incorporated Wells of the Hilldale Manor Subdivision, Lake County, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., and Ianeva, Margarita. B., 2002, *Delineation of Wellhead Protection Areas for the Utilities, Incorporated Wells of the Village of Holiday Hills, Lake County, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., and Ianeva, Margarita. B., 2002, *Delineation of Wellhead Protection Areas for the Community Water Supply Wells of the Village of Newman, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., and Ianeva, Margarita. B., 2002, *Delineation of a Wellhead Protection Area for the Community Water Supply Wells of the Village of Saybrook, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., Ianeva, Margarita. B., and Goldman, Kevin, 2002, *Delineation of Wellhead Protection Areas for the Community Water Supply Wells of the Village of Strasburg, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., and Janson, Kimberly M., 2002, *Delineation of a Wellhead Protection Area for York Center Cooperative, Du Page County, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., and Meyer, Jerry, 2001, *Delineation of Wellhead Protection Areas for the Community Water Supply Wells of the City of Sullivan, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., and Rachman, Elizabeth, 2002, *Delineation of Wellhead Protection Areas for Community Water Supply Wells of the City of Momence, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Sanders, Laura L., and Reyes, Mayra de los, Goldman, Kevin, Getsov, Sarah, Shiu, Yvette, Taylor, Jennifer, and Wehrenberg, Serenity, 2001, *Delineation of Wellhead Protection Areas for Community Water Supply Wells of the Village of Montgomery, Illinois*, Northeastern Illinois University, Chicago, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Scheidt, Brian, Crawford, Craig, and Esling, Steven, 2001, *Delineation of a Well Head Protection Area: Teutopolis, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Scheidt, Brian, and Esling, Steven, 2001, *Delineation of a Well Head Protection Area: Lawrenceville, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Scheidt, Brian, and Esling, Steven, 2001, *Delineation of a Well Head Protection Area: St. Francisville, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Scheidt, Brian, Ghosh, Dipanjan, Aranha, Robert, and Esling, Steven, 2002, *Delineation of a Well Head Protection Area: Fayetteville, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Scheidt, Brian, Jeng, Feng, and Esling Steven, 2002, *Delineation of a Well Head Protection Area: Flat Rock, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Scheidt, Brian, Kirkham Kari, and Esling Steven, 2001, *Delineation of a Well Head Protection Area: New Haven, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Scheidt, Brian, McGuire, Melissa, and Esling Steven, 2002, *Delineation of a Well Head Protection Area: Bone Gap, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Scheidt, Brian, Molander, Emily, and Esling Steven, 2001, *Delineation of a Well Head Protection Area: Montrose, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Scheidt, Brian, True, Adam, and Esling Steven, 2001, *Delineation of a Well Head Protection Area: Norris City, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.

Williams, Sara L., and Booth, Colin J., 2002, *Modeling and Delineation of the Five-Year Recharge Area for the Freeport CWS Facility 1770200, Stephenson County, Illinois*, Northern Illinois University, DeKalb, IL, report to the Illinois Environmental Protection Agency, Springfield, IL.

Zeng, Xun, Reilly, Timothy, and Esling Steven, 2001, *Delineation of a Well Head Protection Area: Hume, Illinois*, Southern Illinois University at Carbondale report to the Illinois Environmental Protection Agency, Springfield, IL.